CATTLE RAISING IN THE UNITED STATES

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ABSTRACT

Per capita consumption of beef rose from 85 pounds in 1960 to 114 pounds in 1970, and is projected to reach about 128 pounds by 1980. Since 1950, cattle feeding has expanded until most calves are now grain fed before slaughter. Additional beef will have to come mainly from increased numbers of cattle. Beef cows grew from 16.7 million in 1950 to 37.3 million in 1970 and are expected to reach 46.3 million by 1980. Milk cows decreased from 23.9 million to 13.9 million over the same period, and are expected to number 12.1 million by 1980.

The Southeast has gained 6.4 million beef cows since 1950 and is expected to add another 2.7 million by 1980. This region offers the greatest potential for future increase of beef cows in the United States. The humid climate and long growing season contribute to good forage production, thus sustaining and encouraging cattle grazing. The Corn Belt and Northern Plains also have substantial growth potential.

Changes within the beef industry, improved forage production and utilization, and an expectation of favorable prices are major factors encouraging expansion in cattle raising. Beef and dairy cattle estimated for 1980 will produce about 127 pounds of beef per capita with a projected population of 230 million. Changes in cattle productivity are anticipated, as are changes in import-export balances.

Keywords: Beef, beef cattle, cattle raising, beef consumption.

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PREFACE

Continued growth and improvement in cattle raising are essential if consumers are to keep getting high-quality beef at reasonable prices from domestic supplies. Rapid development of cattle feeding since 1950 has almost fully exploited the beef-producing potential of both beef and dairy animals.

In this report, past changes in cattle feeding are traced and explained, through available economic analyses and statistical data, together with the judgments of a number of research analysts. The opinions of persons closely associated with cattle raising are used to gauge direction, magnitude, and reasons for changes in cattle raising in the 1970's. Such a comprehensive examination of cattle raising on a national basis helps to identify problem areas and isolate factors deemed most likely to affect growth and improvement of cattle raising throughout the country.

Appreciation is extended to the 295 persons in public service and private industry who provided detailed estimates of the changes they anticipated in cattle raising by 1975 and 1980 and the factors they considered pertinent to these changes.

Information concerning past and expected changes in cattle raising was identified and interpreted by G. E. Frick for the Northeastern States; Roy N. Van Arsdall, Corn Belt and Lake States; Henry C. Gilliam, Southeastern States; James R. Martin and Calvin C. Boykin, Southwestern States; Ronald D. Krenz, Northern Plains; and Richard O. Wheeler, Mountain and Pacific States. The estimate of beef production in 1980 was prepared by Cecil W. Davison and Neil R. Martin, Jr.

Others involved in the study were Ray F. Brokken, C. Kerry Gee, and John E. Trierweiler. Ronald L. Mighell also provided assistance. All are members of the Farm Production Economics Division (FPED), Economic Research Service (ERS), U. S. Department of Agriculture (USDA).

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SUMMARY

Beef production more than doubled from 1950 to 1970. Yet the cattle industry needs to increase its output another third by 1980 to keep pace with trends in population and per capita consumption, according to a nationwide panel of 295 experts in the livestock-raising industry. Combined numbers of beef and milk cows rose from under 41 million in 1950 to 51 million in 1970. Beef cows have been increasing and milk cows decreasing steadily.

Part of the remarkable expansion in beef production in recent years has come from feeding a larger share of the calf crop, including dairy calves. Today, nearly all calves are placed on feed, except those retained for herd replacement or sold for veal. Further growth will require increased numbers of beef cows to supply more feeder calves.

Beef cows have risen in all regions. In general, increases have been relatively greater in the eastern half of the United States. In contrast, milk cow numbers have fallen in all regions, especially where dairying has been important. A price around $30 per 100 pounds for a choice steer calf (450 to 500 pounds) was estimated to be necessary to maintain a relatively stable inventory of beef cows at the 1970 level. A price above $35 would strongly encourage the expansion of beef cow numbers. Generally, experts expected to see prices that would bring on such expansion. Each expert received background data, including projected prices, for selected farm products; and each was asked to rank importance and adoption level of factors affecting productivity per cow and cow numbers in his State.

The 1980 projections of the experts for beef cow numbers came to about 46 million head, compared with 1970 numbers of 37 million. Nearly three-fourths of the growth would be in the Southeast, Northern Plains, and Corn Belt. Since beef production is of minor importance in the Northeast, little change is expected.

The supply of beef estimated for 1980 is 29 billion pounds, or enough for a per capita consumption of 126.7 pounds with a population of 230 million. Based on study conclusions, it is questionable whether measures for additional stimulation of beef cow expansion need be undertaken.

The major addition to the beef supply during the 1970's is expected to come from a greater number of beef cows. The increase would not come as the result of reductions in milk cows or sheep; they provide little potential for beef expansion. Rather, more intensive management practices applied to forage production and utilization are expected to increase beef cow numbers. Techniques include improved methods that result in more and better quality hay and increased salvaging of crop residues.

A majority of the panel members believed that public policy would favor continuing programs which encourage expansion of cattle raising. An example would be a program of low feed grain prices and grazing diverted cropland, which would have an impact on beef production.

Restrictions on antibiotics and growth stimulants will influence beef production, depending on which drugs are withdrawn and what substitutes are found. Increased regulation of herbicides, pesticides, and fertilizers may operate to check crop production and increase forage production. Antipollution laws concerning livestock waste are not likely to affect beef cow operations greatly because they are not usually concentrated.

Higher calving rates and lower calf death losses would directly increase the beef supply. The national calving percentage is expected to rise slightly, from 90 percent in 1970 to 91.6 percent in 1980. Calf death rates, which in 1969 amounted to 5.8 percent of the total calf crop, are expected to decline.

Changes in weights and ages of cull stock will also affect the beef supply, as around 15 percent of the beef and milk cow inventory is replaced annually. Weights of cull cows are expected to increase by 1980.

Larger herd sizes are likely in all regions for 1980, but a high proportion of all cows will remain in small herds. Estimates of weights of 205-day steer calves are about 50 pounds heavier for 1980 than 1970 in the eastern half of the country and almost as much in the Southwest. Weight gains are expected to result from improved selection of breeding stock, crossbreeding, and better nutrition of cows and calves. An increased sales weight of about 50 pounds per head is estimated for both short and long yearlings in the Southwest by 1980.

CATTLE RAISING IN THE UNITED STATES

By

Roy N. Van Arsdall and Melvin D. Skold
Agricultural Economists
Farm Production Economics Division

INTRODUCTION

An earlier U.S. Department of Agriculture report described and traced recent trends in the U.S. cattle-feeding industry (9). 1/ In that report and elsewhere, concern was expressed about the ability of the beef industry to meet the demands for feeder livestock in the future. This report is part of a multiple effort to provide information about potentials for expanding feeder cattle production in the 1970's. First, we trace some of the historical changes in beef cow numbers and feeder cattle production in the several regions of the United States and offer some explanations of the forces behind the trends. Second, we present opinions of a panel of livestock production experts about the potentials for increasing beef cow numbers and feeder calf production in the 1970's. The panel identified factors that they believed to be important in determining the future supply of feeder livestock.

Though this report is largely descriptive, concurrent research will provide additional analyses on means for increasing the supply of feeder cattle. Studies will be made of the potentials for beef cow herds as supplementary enterprises on farms of various types and resource situations across the country. Another topic may be the possibilities for expanding beef cattle production of farms that have beef cattle as the dominant enterprise. A further subject may be an analysis of the impact of shifts among alternative beef enterprises or management systems on the supply of feeder cattle. Regional models are being developed that consider types and sizes of farms within regions and regional supply and demand functions for certain key inputs and products. From these models will come estimates of the supply potential of beef cattle on farms and by regions. Finally, a national aggregative model is being developed to explore the adjustments needed to meet the anticipated demands for feeder cattle.

1/ Underscored numbers in parentheses refer to items in Selected References near the end of this report.

These efforts are complementary. In some, important supply shifters found in this report will be used to guide further investigation. Others will use the same or similar data in their analyses. All are designed to appraise the potential for further increases in beef cow numbers and production of beef per cow in the coming decade.

The Situation

Feeder cattle production has changed significantly in recent decades. Although many of these shifts began earlier, this report focuses on changes since 1960. When available, data are presented back to 1950. Regional data are arranged according to cattle-raising regions with similar conditions (fig. 1).

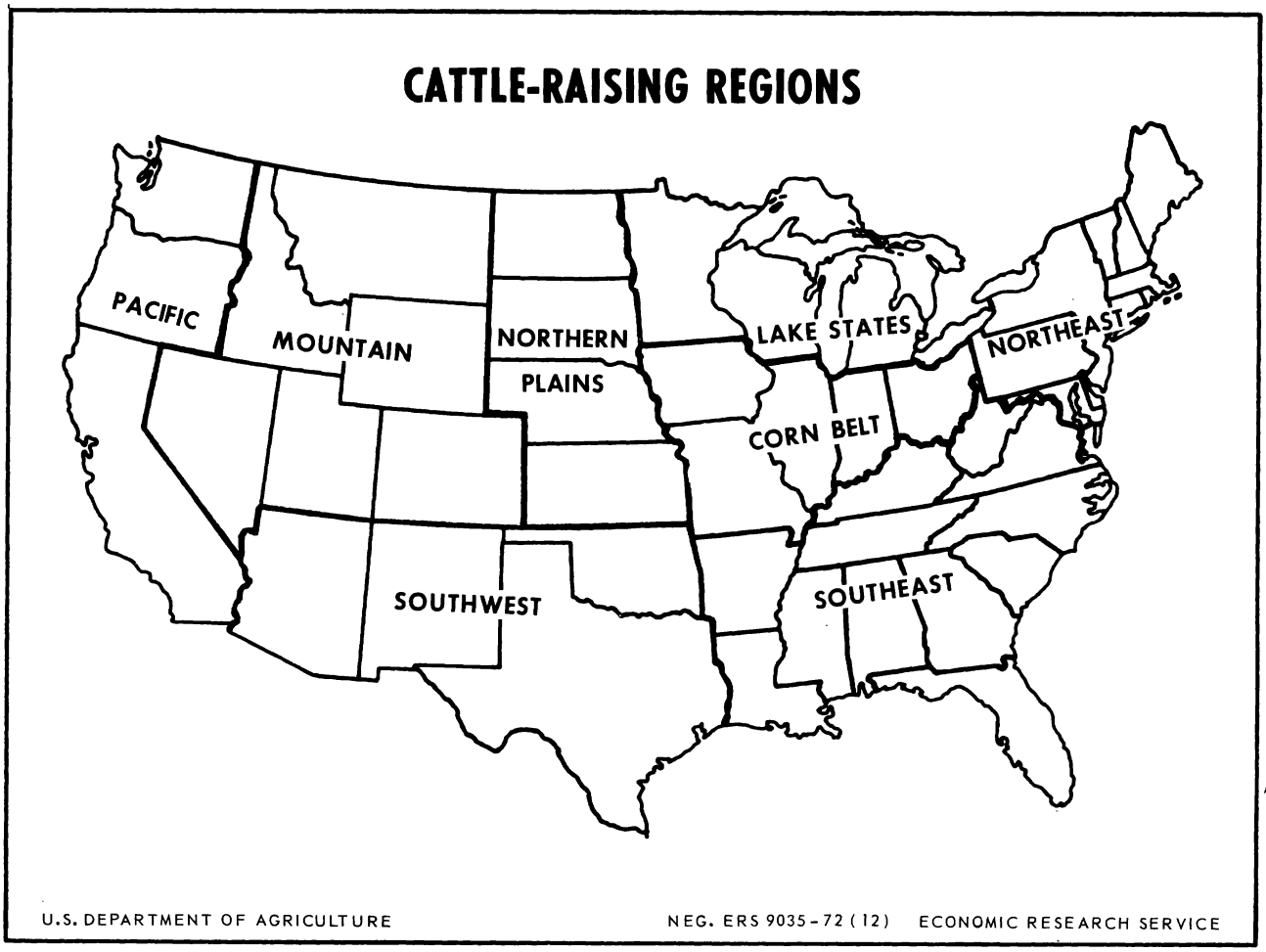

Figure 1

Changes in the cattle-raising, or cow-calf, stage have been less dramatic than those in cattle feeding. Nevertheless, the same forces operated to cause the structural adjustments in both stages. The growth in demand for beef resulting from greater numbers of consumers, rising per capita incomes, and changes in consumer tastes has been met in large part by an increase in the number of animals fed for slaughter. Beef enjoys a favorable demand position. As their incomes have risen, consumers have shown a preference toward more beef in the diet relative to most other foods. Further, they have expressed preferences for alternative cuts of meat and for beef from grain-fed animals as opposed to meat from vealers and grass-finished stock. If present trends continue, increased numbers of feeder cattle must be produced so as to meet needs from domestic supplies.

Calf Slaughter

Increasing proportions of beef calves are being grain-fed before slaughter. Calf slaughter dropped from 8.6 million head in 1960 to about 4.2 million head in 1970, or from 25 percent of total slaughter to 11 percent (table 1). Grain-fed cattle slaughtered rose from 51 percent of all cattle slaughtered in 1960 to 69 percent in 1970. Since 1967, more than half the total calves (beef and dairy) born in the United States have been placed on feed (table 1). Death losses and beef and dairy herd replacements remain a relatively constant proportion of the total. Calves slaughtered, cattle placed on feed, and a small number that are grazed for slaughter make up the rest of the calves.

Specialization in Cattle Feeding

Cattle feeding has become increasingly specialized. The structure of this industry has changed from that of many small feeders active seasonally to one with fewer and larger year-round feeding operations. In the 22 major feeding States for which continuous statistics have been kept, the percentage of cattle marketed from feedlots of greater than 1,000-head capacity increased from 36 to 55 between 1962 and 1970. The shift is more marked in those States in which large-scale feedlots have emerged. The percentage of placing cattle on feed by quarters went from a 21-16-21-42 distribution in 1960 to 21-22-25-32 in 1970. This change illustrates the movement away from seasonal operations. Thus, the demand for feeder cattle is becoming more evenly distributed throughout the year.

Consumption Trends

Per capita consumption of beef rose from 85.2 pounds in 1960 to 113.7 pounds in 1970. That for veal fell from 6.2 to 2.9 pounds in the same period (8). Per capita consumption of beef and veal combined should reach about 130 pounds by 1980 (5). To meet the demand for fed beef, which is expected to continue rising, will require increased numbers of beef cows to produce greater numbers of feeder cattle. In addition, some of the demand can be met by slaughtering at heavier weights.

Table 1--Cattle and calves slaughtered, calves born, and cattle placed on feed, United States, 1950, 1955, and 1960-70

Year	Cattle slaughtered	Calves slaughtered	Calves born	Cattle placed on feed 1/
		Thousands		
1950	18,614	10,501	34,899	NA
1955	26,587	12,864	42,112	NA
1960	26,026	8,611	39,353	13,346
1961	26,467	8,081	40,019	14,049
1962	26,911	7,857	41,441	15,411
1963	28,070	7,204	42,268	15,375
1964	31,678	7,632	43,809	17,548
1965	33,171	7,788	43,928	19,310
1966	34,171	6,861	43,526	21,051
1967	34,295	6,107	43,765	21,834
1968	35,414	5,613	44,239	23,374
1969	35,574	5,010	45,196	24,439
1970	35,354	4,204	45,926	24,426

NA = Not available.

1/ Derived from quarterly estimates of cattle placed on feed: 1960-63, 28-State totals; 1964-67, 32-State totals; and 1968-70, 22-State totals.

Source: (8).

Resource Use Shifts

Past increases in feeder cattle numbers have been possible, in part, because of a decline in the dairy herd and a shift from milk to beef. In certain regions, resources formerly used to support dairying are now used for beef cattle. In other regions, beef cattle have replaced sheep on the range. Often, however, resources utilized by sheep are not economically suited to the support of beef cattle. Future possibilities, then, for continuing to substitute beef for milk cows or sheep depend upon several factors. Per capita consumption trends for dairy products and productivity of milk cows will be important. Suitability of resources and economic conditions of the sheep industry are other keys to the future of sheep-to-beef shifts.

The increased demand for beef has also been met in part by the trend toward grain feeding of cattle. Calf slaughter has decreased to the point where little slack remains in the number of cattle available for feeding. The estimated 1971 calf slaughter of 3.8 million head gives a rough indication of how many calves could be diverted to grain feeding (7).

Objectives

In this report, we explore the possibilities for further increases in the supply of feeder cattle from an expanded cow inventory and from additional production per cow. We also examine the potential for increasing feeder cattle through greater productivity of the beef cow and for expanding the productivity of resources committed to beef.

Can supplies of beef continue to be forthcoming in amounts that will meet a sustained growth in demand yet maintain "reasonable" prices to consumers? Concern is heightened by the fact that much of the increase in beef supplies over the last two decades has resulted from dairy-to-beef shifts and from increases in grain feeding of young beef animals. Neither of these sources holds much potential for further additions to the beef available. Therefore, this report focuses on the potential for increasing output through more efficient utilization of resources available for beef production and through the adoption of improved production technologies.

TRENDS IN BEEF AND MILK COW NUMBERS 2/

Before 1950, there were more milk cows than beef cows in the United States. Beef cow numbers first exceeded milk cow numbers in 1954 and the difference has been increasing ever since (fig. 2). The most rapid growth in beef cow numbers occurred in 1950-55 and in 1958-65. Milk cow numbers have been declining rather steadily since 1954.

The decline in the number of milk cows can be related to the decrease in per capita consumption of dairy products and to increased production per milk cow. Per capita consumption of milk in all dairy products fell from 653 pounds in 1960 to 564 pounds in 1970. Milk production per cow averaged 7,002 and 9,388 pounds in 1960 and 1970, respectively.

2/ The official basis for estimates of cow numbers was altered in 1970 from "cows and heifers 2 years old and over" to "cows that have calved." This change had the effect of shifting about a million beef cows and more than a million milk cows into the heifer category. The Statistical Reporting Service, USDA, developed national estimates on both bases for 1965-70 and State estimates for 1970, but not for other years.

The cow numbers in this report, including projections, are based on the old definition so that historical data can be used. If one wishes to adjust the 1980 projections of beef cow numbers by assuming the 1970 relationships between the two definitions, the resulting numbers would be about 3 percent lower and calving percentages would be raised accordingly.

Some of the 1970 data shown in this report were preliminary at the time the study was made and have been revised slightly since.

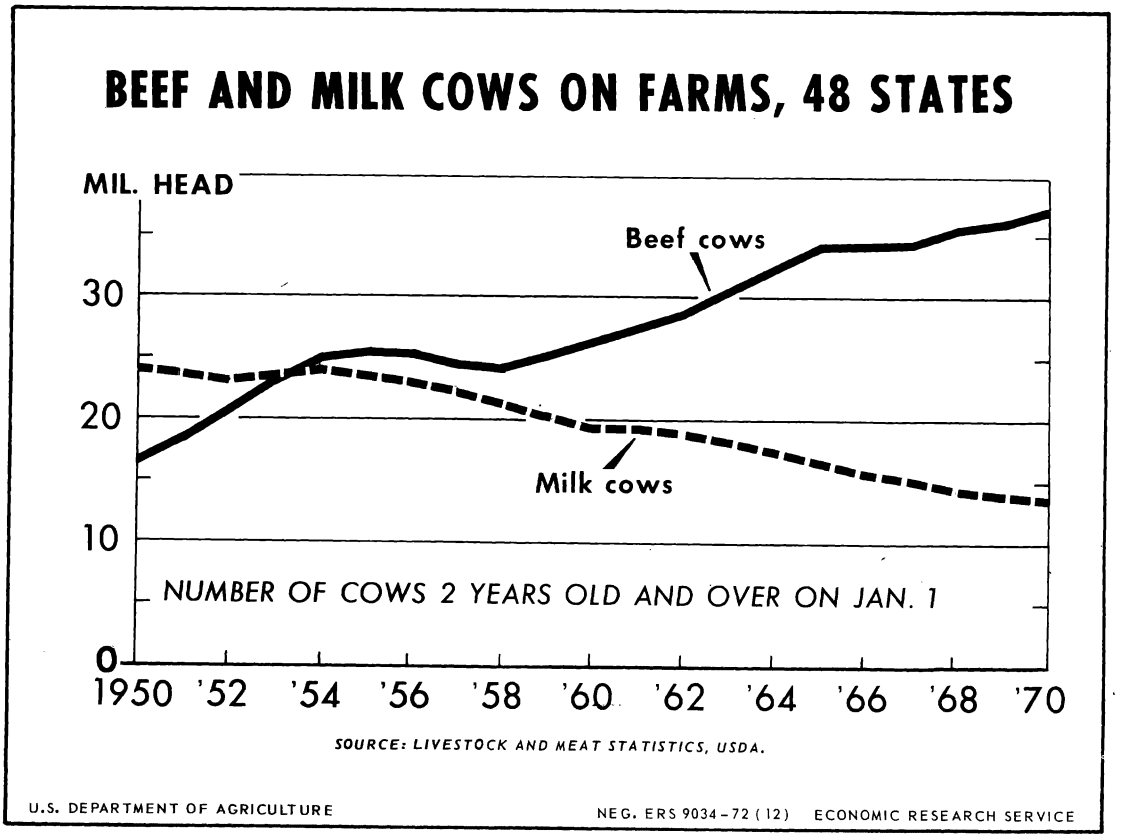

Figure 2

State and Regional Trends

The regions considered in the study are shown in figure 1. For some purposes, the Lake States and Corn Belt have been combined. Regional trends from 1950 to 1970 in numbers of various classes of cattle are discussed below. All regions experienced an increase in beef cow numbers and a decline in milk cows, but the relative changes varied. As noted, numbers grew rapidly in 1950-55, slackened in 1955-58, and increased steadily from 1958 on (fig. 2). As suggested in table 2, these changes followed a relatively favorable price period from 1950 to 1952. Prices were low in 1953-57, and the picture has been relatively favorable since 1958.

Northeast

The Northeast region is of minor importance to beef production (table 3). Total numbers of cattle and calves have declined since 1950. Beef cow numbers started from a very small base and though they have more than tripled, the rise has not been sufficient to offset the 0.8-million-head decline in milk cow numbers. The result was a drop in production of calves that could be used as feeders.

Table 2--Average price per 100 pounds of selected kinds of beef cattle and per capita consumption of beef and veal, United States, 1950-70

Year	All slaughter cattle	Feeder steers	Commercial cows	Per capita consumption of beef and veal
	Dollars per 100 pounds			Pounds
1950	24.06	26.67	21.48	71.5
1951	29.69	32.63	27.76	62.7
1952	25.71	25.55	21.74	69.4
1953	17.66	17.35	13.92	87.1
1954	17.44	18.97	13.28	90.1
1955	16.92	18.27	12.98	91.4
1956	16.34	17.03	12.72	94.9
1957	18.50	20.23	14.83	93.4
1958	23.11	25.85	19.76	87.2
1959	23.91	26.15	19.11	87.1
1960	21.98	23.02	16.21	91.4
1961	21.41	23.28	16.07	93.7
1962	22.95	25.40	15.89	94.6
1963	21.10	22.95	15.11	99.4
1964	19.71	19.79	13.57	105.1
1965	21.37	22.50	14.58	104.7
1966	23.34	25.41	18.31	108.8
1967	23.43	24.67	16.96	110.3
1968	24.63	25.89	17.50	113.3
1969	27.25	29.30	20.07	114.1
1970	27.79	30.15	21.17	116.6

Source: (7).

Table 3--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Northeast, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	75	3,553	5,666	2,991	82
1955	199	3,756	6,304	3,395	86
1960	210	3,406	5,834	3,084	85
1961	211	3,451	5,927	3,105	85
1962	225	3,436	5,946	3,105	85
1963	224	3,385	5,827	3,017	84
1964	224	3,289	5,663	2,959	84
1965	232	3,191	5,524	2,860	84
1966	241	3,018	5,233	2,733	84
1967	237	2,886	5,098	2,638	84
1968	241	2,792	5,101	2,574	85
1969	250	2,739	5,057	2,582	86
1970	258	2,716	5,055	2,543	86

1/ For States in the Northeast, see figure 1.
2/ Cows and heifers 2 years old and over on January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves born by all cows and heifers 2 years old and over on January 1.

Source: (8).

The decline in the number of milk cows in the region is perhaps the single most important factor in explaining the increase in beef cows. The beef herds tend to be small and are often operated as supplementary enterprises by part-time farmers (fig. 3).

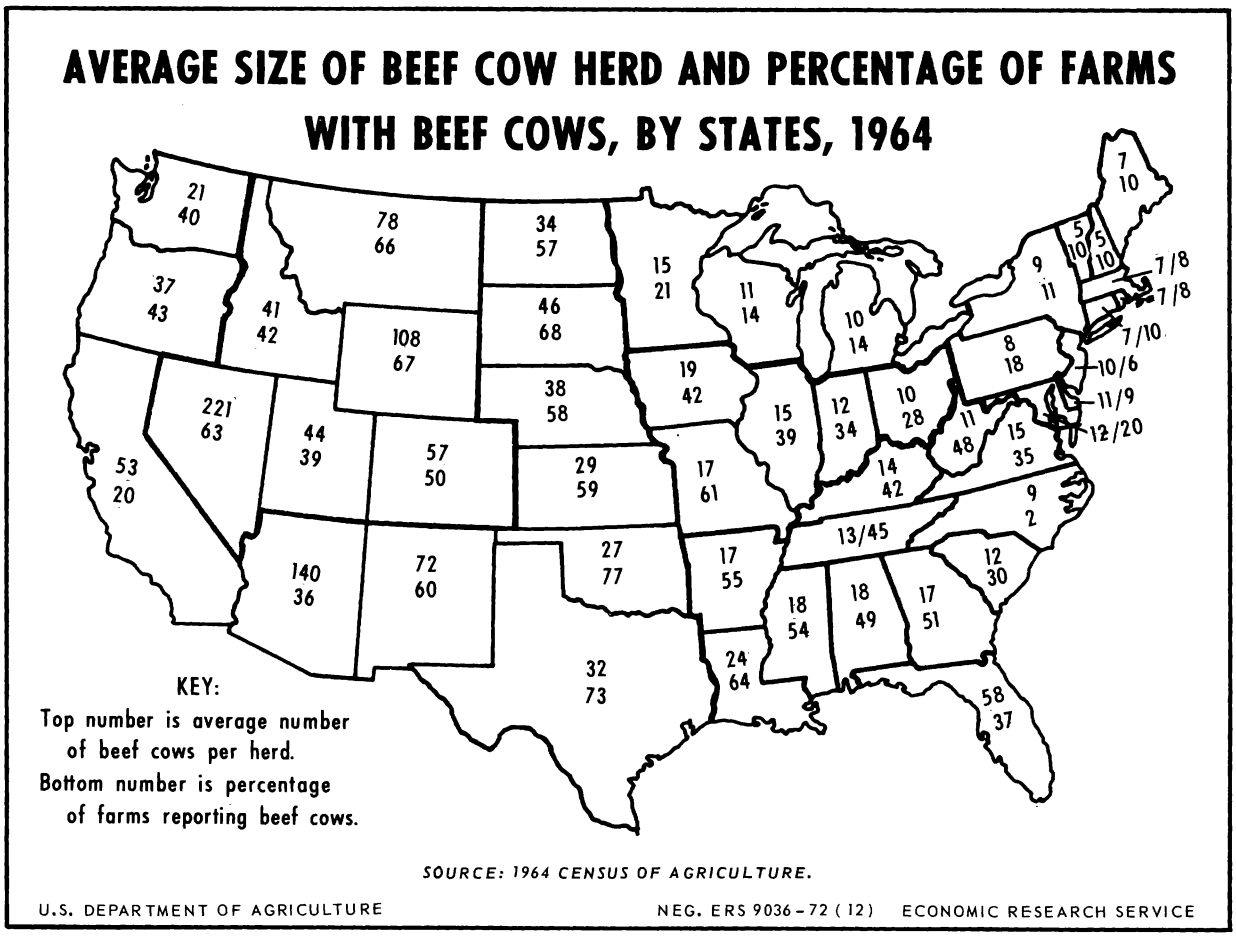

Figure 3

Corn Belt and Lake States

By 1970, beef cow numbers had increased to 2.9 times the 1950 level in the Corn Belt and Lake States, while milk cow numbers had declined to 59 percent (table 4). Total numbers of cattle and calves increased, peaked in the mid-1960's, and declined slightly. The most significant changes occurred in 1950-55. Numbers of cows and heifers 2 years old and over remained relatively constant throughout these years. Most of the increase in total cattle and calf numbers, then, was in the form of young stock, probably animals being grain fed.

Table 4--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Corn Belt and Lake States, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	2,070	9,717	23,805	10,695	91
1955	3,799	9,534	28,749	12,093	91
1960	3,969	8,081	28,747	10,703	89
1961	4,061	8,027	28,943	10,932	90
1962	4,228	8,007	29,480	10,871	89
1963	4,456	7,818	30,208	10,891	89
1964	4,714	7,643	30,624	11,206	91
1965	4,962	7,473	30,747	11,002	88
1966	5,260	6,785	30,010	10,679	89
1967	5,329	6,404	29,559	10,621	91
1968	5,513	6,121	29,174	10,484	90
1969	5,570	5,906	28,963	10,482	91
1970	5,822	5,750	29,252	10,537	91

1/ For States in the Corn Belt and Lake States, see figure 1.
2/ Cows and heifers 2 years old and over on January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves born by all cows and heifers 2 years old and over on January 1.

Source: (8).

The 3.75-million-head increase in beef cows from 1950 to 1970 just about offset the 3.97-million-head decrease in milk cows. Hence, the region has changed relatively little in its calf production. However, the calf crop is higher in quality, as calves are being produced from beef cows.

Land use data from the National Inventory of Soil and Water Conservation Needs give some insight on why total cow numbers have not expanded (3, 4, and table 30). During 1958-67, cropland in the Corn Belt and Lake States increased slightly more than a million acres, or about 0.7 percent. At the same time, pasture lost 2.7 million acres, or almost 9 percent; and forest gained 2.3 million acres, over 3 percent. The beef cow expansion had to come either from improving pasture productivity or from cropland pasture.

Harvested crop acreage dropped some 15 million acres between 1950 and 1969. At the same time, the increase in total acreage of corn, soybeans, and sorghum grain of 15 million acres indicated an intensification of land use. The 15-million acres taken from harvested crop acreage have not gone into pasture. Rather, they have either been withdrawn from agriculture or remained as diverted acres under the commodity programs. Thus, beef cow numbers have not been able to expand further because of their inability to compete for land resources with crops which yield greater economic returns.

The beef cow herds are small on most farms (fig. 3). Small, fragmented landholdings do not lend themselves to enlarging the beef enterprise. Expansion of beef cow enterprises has been most active in the traditionally dairy areas of the Lake States and in areas of relatively low soil productivity in the Corn Belt. Existing resources, especially pasture, roughages, and feed-handling equipment, have encouraged the addition to and expansion of the beef enterprise. Often, a small feeder has established a beef cow herd to supply his own feeder cattle. On the other hand, beef herd additions have been few in the intensively cropped areas of the central Corn Belt even with their relative abundance of forage from crop residues. Lack of fencing, water, and managerial experience in beef production have prevented significant expansion of beef cattle in these areas.

Southeast

The 12 States in the Southeast region had the most dramatic increase in beef cows during 1950-70--about 6.4 million head (table 5). Milk cow numbers fell to less than half the 1950 level. Again, the most rapid shift in numbers of beef cows, total cattle, and calves born occurred during 1950-55. Most of the increase in total cattle came from beef cows rather than feedlots as in the Corn Belt. The upward trend in calving percentages in the Southeast reflects improvement in the quality of cows and adoption of better management practices.

In general, the more northerly States of this region registered larger relative increases in beef cow numbers during 1950-70. The five Appalachian States--Virginia, West Virginia, North Carolina, Kentucky, and Tennessee--moved from having less than a fourth of the beef cows in the entire Southeast in 1950 to slightly more than a third in 1970. Consolidation of many relatively small farms with subsequent mechanization of crop production,

Table 5--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Southeast, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	2,816	4,767	13,201	5,948	78
1955	5,622	4,862	18,178	8,282	79
1960	5,993	3,716	17,244	7,708	79
1961	6,090	3,639	17,415	7,843	81
1962	6,429	3,556	17,745	8,085	81
1963	6,798	3,441	18,033	8,291	81
1964	7,232	3,279	18,635	8,519	81
1965	7,452	3,136	18,886	8,996	85
1966	8,281	2,767	19,651	9,025	82
1967	8,308	2,617	19,631	9,260	85
1968	8,492	2,512	19,967	9,482	86
1969	8,818	2,406	19,995	9,863	88
1970	9,167	2,356	20,407	9,911	86

1/ For States in the Southeast, see figure 1.
2/ Cows and heifers 2 years old and over on January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves born by all cows and heifers 2 years old and over on January 1.

Source: (8).

relatively rapid development and dispersion of industrial activity in parts of the region, and the introduction and promotion of improved pastures probably contributed the most to this greater growth.

Before the end of World War II, the typically small, intensively cropped farms in the Southeast region provided only limited acreages of pastureland per farm. The relatively low productivity of native grasses further restricted animal-carrying capacity, so that many farms could not support economic-sized beef cow herds. The introduction in the late 1940's of tall fescue, called the "wonder grass," and other improved pasture species provided a substantial boost to pasture productivity. The trend to larger scale, mechanized crop production resulted in two developments, both of which tended to favor beef cow expansion. Many farm operators acquired larger acreages that, because of topography or soil conditions, were suitable primarily for grazing. Others with small farm holdings chose to take off-farm employment while continuing to farm part-time. Beef cow enterprises were frequently adopted by such operators because of the relatively small and flexible labor needs.

As indicated earlier, milk cow numbers in the Southeast declined about 2.4 million head between 1950 and 1970 (table 5). Some of the land and other resources thus released were put to other uses but shifts from milk to beef cows have been rather common.

Much of the decline in milk cow numbers in these States during the last two decades represented cows used to produce manufacturing grade milk. In 1948, for example, about 42 percent of all milk sold to plants and dealers in the Southeast was manufacturing grade. By 1968, such milk constituted only about 15 percent of all milk sales in the region.

Northern Plains

The four States in the Northern Plains more than doubled beef cow numbers during 1950-70. As in other regions, a large decrease occurred in milk cow numbers, but total cattle increased 7.4 million head (table 6). Increases in the beef cows in these States have come in spurts rather than as a steady growth. Large gains occurred from 1950 to 1955, and from 1960 to 1965, and probably will occur in the early 1970's. Between these periods, beef cow numbers remained relatively constant or declined slightly but growth started each time from a higher trough. Irregular increases in beef cow numbers have been observed in other regions also.

The phenomenon of uneven growth has not been analyzed critically, but some hypotheses can be offered. First, the increase in number of beef cows corresponds to fluctuations in the prices of beef. Second, Federal commodity programs may have affected numbers. Wheat allotment programs appeared in 1953. Some of the land which could not be planted to wheat was probably allocated to livestock. The U.S. feed grain program was established in 1961. Again, diverted acres may have found their way into uses which help to support livestock. Further, the Conservation Reserve program of the 1950's, which was especially used in the Northern Plains, diverted marginal cropland to permanent pasture for livestock.

Table 6--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Northern Plains, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	3,121	1,903	11,380	4,497	90
1955	4,809	1,735	14,680	5,845	89
1960	4,592	1,332	14,521	5,356	90
1961	4,744	1,305	14,904	5,528	91
1962	4,980	1,280	15,762	5,720	91
1963	5,282	1,214	16,781	5,946	92
1964	5,716	1,163	17,785	6,328	92
1965	5,982	1,134	17,754	6,443	91
1966	6,093	999	18,547	6,365	90
1967	6,118	935	18,612	6,502	92
1968	6,177	883	18,413	6,567	93
1969	6,287	834	18,396	6,659	94
1970	6,410	798	18,822	6,837	95

1/ For States in the Northern Plains, see figure 1.
2/ Cows and heifers 2 years old and over on January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves born by all cows and heifers 2 years old and over on January 1.

Source: (8).

Although most areas in the region have experienced an increase in beef cow numbers, the relative changes have not been uniform. In general, the more humid, eastern portions showed the greatest rise in beef cow numbers. Exceptions are southwestern and south-central North Dakota, which had relatively large numbers of beef cows at the start of the period.

On farms with cattle, herd size has grown considerably in recent years. The beef cow herd is becoming major rather than a supplementary enterprise. Between 1960 and 1970, the average size increased from 16 to 42 in North Dakota, from 26 to 44 in South Dakota, and from 19 to 34 in Nebraska. (Comparable information is not available for Kansas.)

Land use data do not indicate any major shift in the categories of cropland, pasture or hay (table 30). Apparently, the increase in beef cow numbers came through better management of forage resources. Improved pasture and forage crops and more complete utilization, together with declines in milk cows, seem to explain a large part of the increases in beef cow numbers in the Northern Plains. Also, consolidation of landholdings made larger acreages of pasture available per farm and encouraged cattle raising in the same way as in the Southeast.

Southwest

Much of the land in the Southwest is pastureland, rangeland, or timberland, capable in different degrees of supporting livestock grazing. Considering the low average annual rainfall, the hilly terrain, and the thin, rocky soils from which only a small amount of suitable forage is produced, livestock grazing is about the only agricultural use for most of these resources. The Federal Government, through the U.S. Department of Interior's Bureau of Land Management and USDA's Forest Service, manages a large proportion of the lands in the region, particularly in Arizona and New Mexico. Livestock grazing is a long-recognized use. State-owned land is also significant in the region, and livestock are grazed on much of it. Privately owned lands provide most of the forage supply in Oklahoma and Texas, but such holdings are combined with State and Federal lands for cattle raising in Arizona and New Mexico.

The Southwest started the period with more beef cows--over 5 million head--than any other region. Even with this large base, beef cow numbers in the four States increased more than 3.9 million head from 1950 to 1970. Total numbers of all cattle and calves rose to 1.5 times the 1950 levels, and numbers of beef and milk cows increased 2.7 million head (table 7). The more rapid increase in total cattle than in beef or milk cows is accounted for by the expansion of cattle feeding in these States.

The Southwest has great extremes in elevation, topography, climate, soils, and vegetation. Thus, generalizations about historical and current patterns of livestock production are inadvisable. Except for the higher mountain areas of central Arizona and north-central New Mexico, however, yearlong grazing is possible. Yet the extremes in climate and vegetation prevent this common thread from uniting the four States into any kind of homogeneous livestock production region.

Table 7--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Southwest, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	5,081	1,827	12,692	5,954	86
1955	6,311	1,452	13,925	6,695	86
1960	6,564	1,037	14,631	6,400	84
1961	6,832	984	15,113	6,541	84
1962	7,153	965	15,591	6,868	85
1963	7,702	931	16,416	7,126	83
1964	8,096	881	16,728	7,356	82
1965	8,055	834	16,675	7,524	85
1966	8,200	729	17,350	7,563	85
1967	8,279	689	17,554	7,759	87
1968	8,428	664	17,958	7,960	88
1969	8,697	634	18,841	8,309	89
1970	8,995	635	19,885	8,456	88

1/ For States in the Southwest, see figure 1.
2/ Cows and heifers 2 years old and over January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves born by all cows and heifers 2 years old and over on January 1.

Source: (8).

Numbers of beef cows in Arizona remained relatively constant between 1950 and 1970; in fact, the data reflect a slight decline. At the same time, milk cows showed a slight increase of about 5,000 head. Beef cow numbers went up 89,000 head, or 14 percent, in New Mexico, although milk cow numbers in 1970 dropped to less than 70 percent of the 1950 level (figs. 4 and 5). Oklahoma and Texas showed the most significant changes in beef cows. Oklahoma experienced an increase of 1.4 million in numbers while in Texas, figures rose 2.4 million. Each of these States also had a larger drop in milk cows.

Most of the increases in beef cows in Arizona and New Mexico occurred outside the irrigated, intensively cropped areas. In Oklahoma, the increase in beef cow numbers has been spread rather evenly over the State. Most of the expansion in Texas, however, has occurred in the more humid portions of the State. In both Oklahoma and Texas, mixed crop-livestock farming has been more important than ranching in the rise of beef cow numbers.

Part of the increase in beef cow numbers in the Southwest consisted of a substitution of beef cows for milk cows. This practice occurred particularly in the more humid areas with more highly productive ranges and pastures capable of providing a larger proportion of total animal nutritional needs. Also, forage, hay, and feed grains formerly grown for dairy cattle were probably fed supplementally to cattle on ranges and pastures in all areas.

The most significant land use changes concerning beef cattle production occurred on private lands. Between 1958 and 1967, shifts included a 12.8-percent reduction in the acreage of cropland, a 4.3-percent increase in pasture and range (only in Oklahoma and Texas as pasture), and a 1.4-percent reduction of forest acreage (table 30).

Changes in beef cows and pasture acreages in the Southwest formed a consistent pattern. Arizona, which experienced a drop in range acreage, had a modest decline in beef cow numbers. New Mexico had a slight increase in the acreage of range and a corresponding rise in beef cow numbers. Beef cow numbers in Texas tended to increase most in those areas with the greatest rise in pasture acres. In Oklahoma, the increase in pasture acreage was general throughout the State as was that in beef cattle.

Mountain

Beef cow numbers almost doubled during the last two decades in the Mountain region. Numbers of milk cows declined from a relatively small base, and total numbers of cows and heifers 2 years old and over went up 1.9 million head. Again, the more rapid rise in total number of cattle and calves than in number of beef and milk cows indicated an increase in grain-feeding operations, especially in Colorado (table 8).

Each of the Mountain States had a similar pattern of growth in beef cow numbers, a sizable increase between 1950 and 1955. Relative stability held from 1955 to 1960, and numbers went up steadily after the early 1960's.

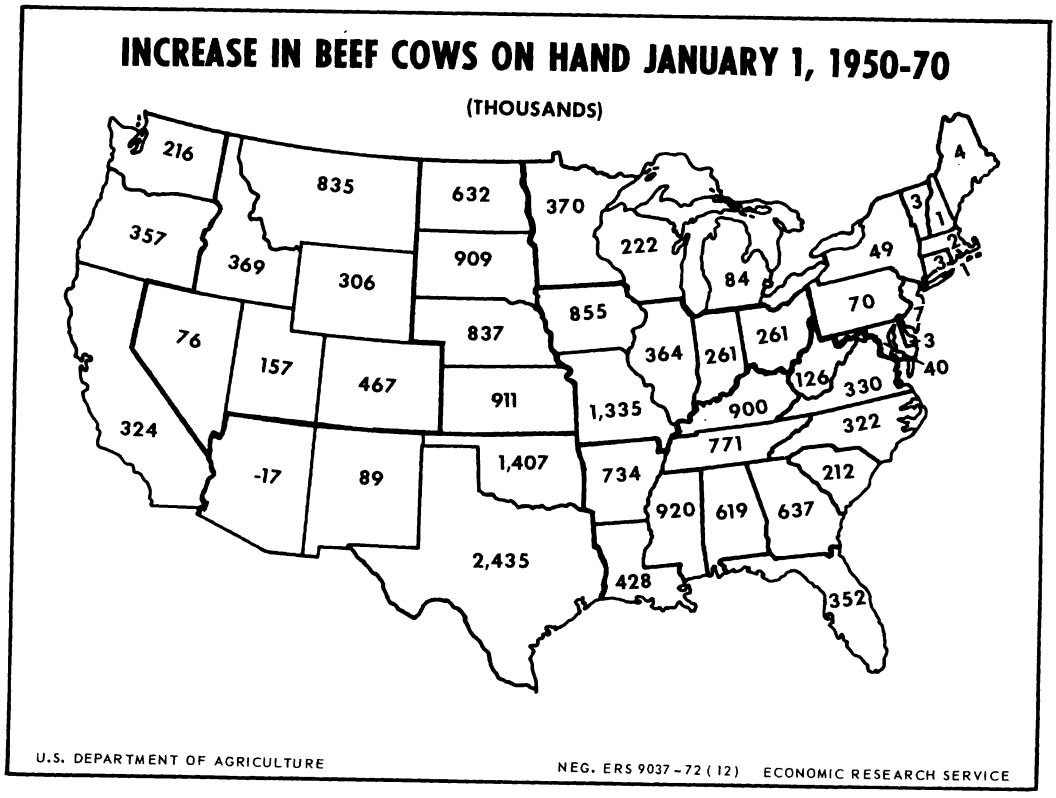

Figure 4

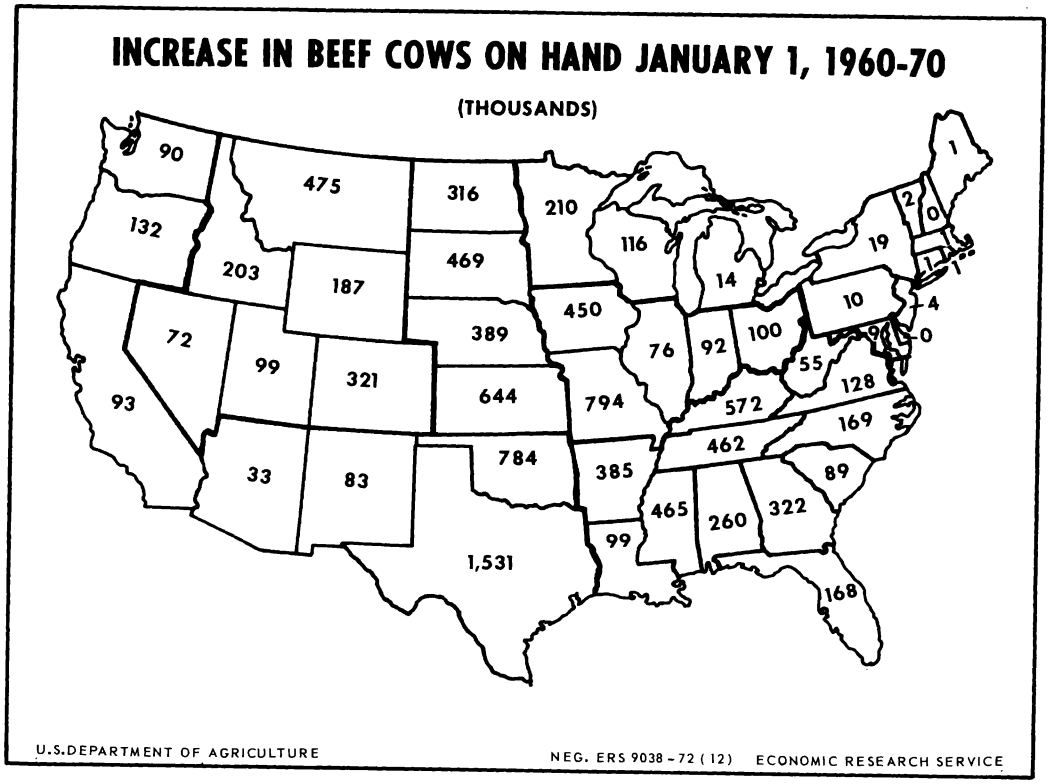

Figure 5

Table 8--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Mountain States, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	2,473	717	6,574	2,776	87
1955	3,293	692	8,247	3,585	90
1960	3,326	614	8,370	3,481	88
1961	3,384	594	8,167	3,516	88
1962	3,465	582	8,292	3,614	89
1963	3,636	567	8,850	3,768	90
1964	3,826	555	9,437	3,937	90
1965	4,027	537	9,643	4,134	91
1966	4,219	468	10,037	4,221	90
1967	4,245	453	10,117	4,254	91
1968	4,397	446	10,440	4,454	92
1969	4,484	447	10,615	4,603	93
1970	4,683	445	10,940	4,729	92

1/ For States in the Mountain region, see figure 1.
2/ Cows and heifers 2 years old and older on January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves by all cows and heifers 2 years old or over on January 1.

Source: (8).

The Mountain region, like the Southwest, has a heterogeneous livestock production pattern. The differences in annual precipitation are extreme, and range areas vary from intermountain desert to high mountains. Beef cattle production occurs under three environmental and resource situations--climate, topography, and alternative enterprises--and these impose three different management systems. The first, mountain ranching, is found in each State. Ranchers tend to combine privately owned irrigated meadows, principally in hay production, with range and pasture. These private lands are supplemented with grazing permits to public lands, usually operated by either the Bureau of Land Management or the Forest Service. The second type of ranching occurs on the desert. Again, combinations of private and public land prevail. Some irrigated hayland may exist, but greater reliance is placed on yearlong grazing than is possible under high-mountain situations. The third type of beef production occurs on mixed crop-livestock farms in either a plains-type environment or along irrigated river valleys. Beef herds may be either major enterprises on these farms or they may occur as relatively small supplementary enterprises.

Indications are that the beef cow inventory has expanded under each of these types of operations during the last two decades. However, the relative changes vary and stem from different sets of circumstances.

In much of the desert and mountain ranching areas, sales of livestock products typically constitute three-fourths of total farm income. In recent years, increases in livestock production in these areas have been accomplished through greater productivity and efficiency in the use of forage resources. Fertilization of irrigated meadows to increase hay yields, range improvement, rotational grazing, and more complete use of available resources have contributed in varying degrees to expansion of numbers. In addition, beef cattle have replaced sheep on some of these ranches. The generally poor market for sheep and wool, together with the increasing difficulty of obtaining labor, undoubtedly explains the substitution of beef for sheep where possible.

In the mixed grain-livestock farming areas, the increase of feeder cattle production has been greatest. As farms consolidate, forage resources are available in units capable of supporting an economically viable beef herd. Forage resources used by these cattle are combinations of native pasture, cropland pasture, and aftermath grazing. As irrigation develops, either from surface or underground sources, potentials for cropland, irrigated pasture, or aftermath grazing are further increased.

Pacific States

An 80-percent increase in beef cow numbers occurred in the three Pacific States during the 20-year period. Again, over half the increase in numbers came between 1950 and 1955. Relative to other regions, this region had the most stability in milk cow numbers, which probably reflects increased State populations. During 1950-70, the combined beef and milk cow inventory expanded only 0.7 million head. Total numbers of all cattle and calves increased more than 3.0 million head, which is associated with the growing importance of grain feeding, particularly in California (table 9).

Table 9--Beef cows, milk cows, and total cattle on farms January 1, calves born, and calving percentage, Pacific States, 1950, 1955, 1960-70 1/

Year	Beef cows 2/	Milk cows 2/	Total cattle 2/, 3/	Calves born 4/	Calving percentage 5/
	Thousands				Percent
1950	1,107	1,369	4,645	1,985	80
1955	1,626	1,431	6,509	2,680	88
1960	1,689	1,341	6,703	2,621	87
1961	1,706	1,342	6,850	2,644	87
1962	1,748	1,322	6,966	2,698	88
1963	1,795	1,304	7,397	2,723	88
1964	1,921	1,273	7,660	2,833	89
1965	1,987	1,269	7,728	2,894	89
1966	2,050	1,201	7,793	2,862	88
1967	2,080	1,196	7,830	2,877	88
1968	2,066	1,191	7,849	2,865	88
1969	2,026	1,169	7,765	2,838	89
1970	2,004	1,158	7,714	2,832	90

1/ For States in the Pacific region, see figure 1.
2/ Cows and heifers 2 years old and over on January 1.
3/ Includes all cows, heifers, calves, steers, and bulls kept for beef and milk.
4/ Calves born during the year.
5/ Computed by dividing the number of calves by all cows and heifers 2 years old and over on January 1.

Source: (8).

Again, because of differences in climate and topography, livestock production in the Pacific States is difficult to characterize. As in the Mountain States, beef cows are kept under mountain ranching, intermountain desert, and mixed crop-livestock situations. In addition, they are found in large valleys lying between the Coastal Range and the Sierra Nevada and Coastal ranching areas.

Beef cow numbers in California increased substantially between 1950 and 1955, remained relatively constant until 1964, and have risen only modestly since. Oregon and Washington also experienced a sizable increase between 1950 and 1955 and have continued on a rather steady upward trend. As in the Mountain States, beef herd increases have come from increased production and utilization of forage in areas where livestock have traditionally accounted for most of the farm income.

The largest numbers of beef cows in California are concentrated along the central coast, the foothills of the Sierras, and in the Sacramento and San Joaquin Valleys. Most of the herds raised in the valleys are scattered along the edges, where combinations of foothill ranges and irrigated cropland occur. Others are carried as supplementary enterprises on crop farms within the valleys.

In Oregon, the largest concentration of beef cattle occurs in the Columbia Basin. Eastern Oregon is second in numbers, followed by the western, southern, and central sections. In recent years, the largest numerical increase in beef cows occurred in the western part. Among factors contributing to the western increase are: substitution of beef for milk cows and sheep, utilization of lands left cleared or partially cleared by logging activities, and grazing of lands soon destined for nonagricultural uses. In addition, hay and pasture production have increased largely because of the introduction of Flemish hay varieties and improved grass and clover pastures.

Beef cow numbers in Washington show a pattern like that of Oregon. The largest numbers are in the eastern part of the State, followed by the Yakima Valley, western Washington, and the Columbia Basin. Western Washington has been gaining relative to other areas of the State, largely for the same reasons as in western Oregon.

Regional Distribution of Cows

When appraising the feeder cattle supply, it is important to examine total cow numbers rather than beef cows only. Potentially, all calves from milk cows, except those needed for herd replacements, could be made available for feeders. In general, those regions with a small milk cow inventory relative to beef cow numbers showed the most marked increase in total cow numbers. The downward trend in milk cows did not work to offset the strong upward trend in beef cow numbers for regions in which dairying is less significant.

Grain feeding has greatly increased in recent years, so it is important to focus on changes in cow numbers rather than on changes in total cattle and calf numbers. As mentioned earlier, the rise of grain feeding in certain regions tends to divert attention from cow numbers and feeder cattle production.

Table 10 gives regional percentage distributions of beef and milk cows for selected years. The eastern half of the United States has gained an increased proportion of the total beef cow inventory at the expense of the western half.

On the other hand, the Northeast, Corn Belt, Lake States, and Pacific regions gained in relative national importance in dairying at the expense of the Southeast, Northern Plains, and Southwest. The Mountain region retained its same relative position. The net trend has been for inventories of beef and milk cows combined to become somewhat less concentrated in the more humid regions of the United States.

A graphic picture of the change in beef cow numbers was presented in figures 4 and 5. The differences in absolute numbers during 1950-70 are most striking for the Plains, Central, and Southern States. Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Montana, Iowa, Missouri, Arkansas, Kentucky, Tennessee, Mississippi, Alabama, and Georgia all had increases of more than 500,000 head.

Sheep

In certain places, sheep compete with beef cattle for forage resources. Sheep, like milk cows, have been declining in numbers in recent years; the stock sheep inventory dropped from 26.2 million in 1950 to 17.4 million head in 1970 (table 11). On a feed-weighted animal unit basis, sheep and cattle substitute at about a one-to-five rate; that is, one cow equals about five sheep. Thus, the 8.8-million-head reduction in sheep could only account for an increase of about 1.8-million-head in the beef cow inventory, even if all of the resources released from sheep production were utilized for beef cattle.

All regions of the United States showed declines in stock sheep numbers. The Northern Plains had a larger inventory in 1970 than in 1950 but the 1970 numbers are considerably less than those for 1960. The numbers in the Northern Plains and Mountain regions declined somewhat less rapidly. The drop in numbers of stock sheep does not go very far toward explaining the increase in beef cow numbers. Although sheep numbers probably will continue to decline, size of the beef inventory is unlikely to increase as a result.

Size Distribution of the Beef Cow Herd

The historical perspective on numbers of various types of cattle by regions is useful in appraising supply and adjustment potentials. Also

Table 10--Beef, milk, and all cows by regions, selected years 1950-70

Region	1950	1955	1960	1965	1970	1950	1955	1960	1965	1970
	Thousands					Percent				
	Beef cows									
Northeast	75	199	210	232	258	0.5	0.8	0.8	0.7	0.7
Corn Belt and Lake States	2,070	3,799	3,970	4,962	5,822	12.4	14.8	15.1	15.2	15.6
Southeast	2,816	5,622	5,993	7,452	9,167	16.8	21.9	22.8	22.8	24.5
Northern Plains	3,121	4,809	4,592	5,982	6,410	18.6	18.8	17.4	18.3	17.2
Southwest	5,081	6,311	6,564	8,055	8,995	30.3	24.6	24.9	24.6	24.1
Mountain	2,473	3,293	3,326	4,027	4,683	14.8	12.8	12.6	12.3	12.5
Pacific	1,107	1,626	1,689	1,987	2,004	6.6	6.3	6.4	6.1	5.4
48 States	16,743	25,659	26,344	32,697	37,339	100.0	100.0	100.0	100.0	100.0
	Milk cows									
Northeast	3,553	3,756	3,406	3,191	2,716	14.9	16.0	17.5	18.2	19.6
Corn Belt and Lake States	9,717	9,534	8,081	7,473	5,750	40.7	40.6	41.4	42.5	41.5
Southeast	4,767	4,862	3,716	3,136	2,356	20.0	20.7	19.0	17.8	17.0
Northern Plains	1,903	1,735	1,332	1,134	798	8.0	7.4	6.8	6.5	5.7
Southwest	1,827	1,452	1,037	834	635	7.7	6.2	5.3	4.7	4.6
Mountain	717	692	614	537	445	3.0	3.0	3.1	3.1	3.2
Pacific	1,369	1,431	1,341	1,269	1,158	5.7	6.1	6.9	7.2	8.4
48 States	23,853	23,462	19,527	17,574	13,858	100.0	100.0	100.0	100.0	100.0
	All cows									
Northeast	3,628	3,955	3,616	3,423	2,974	8.9	8.1	7.9	6.8	5.8
Corn Belt and Lake States	11,787	13,333	12,051	12,435	11,572	29.0	27.2	26.3	24.7	22.6
Southeast	7,583	10,484	9,709	10,588	11,523	18.7	21.3	21.2	21.1	22.5
Northern Plains	5,024	6,544	5,924	7,116	7,208	12.4	13.3	12.9	14.2	14.1
Southwest	6,908	7,763	7,601	8,889	9,630	17.0	15.8	16.6	17.7	18.8
Mountain	3,190	3,985	3,940	4,564	5,128	7.9	8.1	8.6	9.1	10.0
Pacific	2,476	3,057	3,030	3,256	3,162	6.1	6.2	6.6	6.4	6.2
48 States	40,596	49,121	45,871	50,271	51,197	100.0	100.0	100.0	100.0	100.0

Source: (8).

Table 11--Stock sheep on farms, by regions, selected years 1950-70

Region	1950	1955	1960	1965	1970
			Thousands		
Northeast	443	549	536	462	325
Corn Belt and Lake States	4,289	4,918	5,044	3,883	2,761
Southeast	1,735	1,902	1,772	938	583
Northern Plains	1,595	2,193	2,982	2,455	1,797
Southwest	8,348	7,150	7,541	6,244	4,727
Mountain	7,241	7,620	8,104	6,889	5,432
Pacific	2,531	2,805	2,870	2,408	1,759
48 States	26,182	27,137	28,849	23,279	17,384

Source: (8).

important are the average size of herd and the percentage of farms reporting cows (fig. 3) and the size distribution of beef cow herds (tables 12 and 13). The average size of the beef cow herd in 1964 was small for most States. Usually, this average size is larger in States with traditional range livestock operations. Thus, Florida stands out among the Eastern States, and the 17 Western States also have significantly higher average herd sizes. For States known to have a large number of mixed crop-livestock farms, the average herd size is small. In contrast, beef cattle production occurs almost exclusively on large specialized livestock ranches in Arizona, Nevada, and Wyoming.

Tables 12 and 13 indicate that beef cows are scattered among a large number of very small herds within any given region. Unfortunately, corresponding data for 1969 are not available to compare with those for 1964. 3/ In 1964, over two-thirds of U.S. farms reporting beef cows had herds with fewer than 20 cows and almost 90 percent had herds with fewer than 50. Thus, about 46 percent of all beef cows were in herds of 50 or fewer and over 20 percent were in herds of fewer than 20. From the other end of the spectrum in 1964, less than 4 percent of the producers had 37 percent of the beef cow inventory, and about 10 percent of the producers had 54 percent of the inventory.

3/ The 1969 Census data by herd size are available only for commercial farms in economic classes I to V inclusive. Left out are all farms in class VI, part-time, part-retirement, and abnormal categories. Consequently, a large number of small farms with beef cows are missed and the apparent herd size distribution is distorted, a distortion especially noticeable in the Southeast region where there are many small herds. The limited 1969 size data are shown in tables 33 and 34.

Table 12--Beef cows by size of herd and regions, 1964

Region	Size of herd (cows)				
	1 to 19	20 to 49	50 to 99	100 and over	Total
			Number		
Northeast	143,215	81,156	32,222	22,080	278,673
Corn Belt and Lake States	1,925,374	2,102,916	722,998	320,185	5,071,473
Southeast	2,318,764	2,047,382	1,209,959	2,258,288	7,834,393
Northern Plains	718,500	1,689,675	1,451,791	2,033,166	5,893,132
Southwest	1,165,508	1,643,818	1,253,000	3,623,792	7,686,118
Mountain	179,167	469,469	691,188	2,650,601	3,990,425
Pacific	202,350	240,146	266,545	1,176,375	1,885,416
48 States	6,652,878	8,274,562	5,627,703	12,084,487	32,639,630
			Percent		
Northeast	51.4	29.1	11.6	7.9	100.0
Corn Belt and Lake States	38.0	41.5	14.3	6.2	100.0
Southeast	29.6	26.1	15.5	28.8	100.0
Northern Plains	12.2	28.7	24.6	34.5	100.0
Southwest	15.2	21.4	16.3	47.1	100.0
Mountain	4.5	11.8	17.3	66.4	100.0
Pacific	10.7	12.7	14.2	62.4	100.0
48 States	20.4	25.3	17.3	37.0	100.0

Source: (12). Data based on all farms.

Table 13--Farms with beef cows, by size of herd and regions, 1964

Region	Size of herd (cows)				
	1 to 19	20 to 49	50 to 99	100 and over	Total
			Number		
Northeast	28,104	2,873	492	137	31,606
Corn Belt and Lake States	248,137	73,325	11,312	2,033	334,807
Southeast	354,056	70,184	18,357	9,901	452,498
Northern Plains	76,454	54,694	21,592	10,480	163,220
Southwest	142,366	55,045	18,719	13,655	229,785
Mountain	23,833	14,639	9,876	10,597	58,945
Pacific	35,949	7,845	3,848	4,280	51,922
48 States	908,899	278,605	84,196	51,083	1,322,783
			Percent		
Northeast	88.9	9.1	1.6	0.4	100.0
Corn Belt and Lake States	74.1	21.9	3.4	.6	100.0
Southeast	78.2	15.5	4.1	2.2	100.0
Northern Plains	46.8	33.6	13.2	6.4	100.0
Southwest	62.0	24.0	8.1	5.9	100.0
Mountain	40.4	24.8	16.8	18.0	100.0
Pacific	69.2	15.1	7.4	8.3	100.0
48 States	68.7	21.1	6.3	3.9	100.0

Source: (12). Data based on all farms.

The Northeast, Corn Belt, Lake States, and Southeast showed size distributions favoring the small herd more than did the national averages. In the Northeast, 98 percent of the producers had herds of 1-19 or 20-49 cows, which contained over 80 percent of all cows. These two groups included 96 percent of the producers and 80 percent of the cows in the Corn Belt and Lake States, and 94 percent of the producers and 56 percent of the cows in the Southeast.

On the other hand, regions in the western half of the United States reported size distributions showing proportionately fewer small herds than the national average. In the Northern Plains, 80 percent of the producers and only 40 percent of the cows were in the two groups with herds of less than 50 cows. In the Southwest, the figures were 86 percent of the producers and only 37 percent of the cows; in the Mountain region, 65 percent of the producers and 16 percent of the cows; and in the Pacific region, 84 percent of the producers and 23 percent of the cows.

Despite the rapid increases in the beef cow inventory, the typical beef cow herd tends to be rather small and supplementary. Several implications for supply response and adjustments follow. If the beef cow enterprise is supplementary, the response to favorable beef prices and other economic incentives may be limited. Small beef cow herds may use only resources for which there is little alternative. Part-time farmers may maintain a small labor-extensive beef cow herd. Thus, a great many of the producers and a large proportion of the beef cow inventory may not respond to price and cost changes. The preponderance of small herds may also limit technological change. Certain innovations are likely to be adopted only by larger operators because of the economics of the technique. Many of the Nation's feeder cattle are produced on small and fragmented landholdings. Anyone projecting an increase in beef cow numbers and the resultant supply of feeder cattle must recognize this structural characteristic of the industry. Unless the economics and technology of feeder cattle production make it impossible to do so, a sizable proportion of further expansion in beef cow numbers will probably come by more fully exploiting these small holdings. Further increases in part-time farming activities and continued farm consolidation may both be important in shaping increases in beef supplies.

Summary of Trends in Numbers and Herd Size

As noted above, all regions have experienced the upward trend in beef cow numbers and feeder calf production. In the aggregate, this increase can be attributed in part to producer response to a favorable price expectation for beef related to rising consumer demands. Per capita consumption of beef and veal has gone rather consistently upward despite fluctuations in the price of beef. Table 2 indicated the average prices for slaughter cattle, feeder steers, and commercial cows in 1950-70. As would be expected, all three price series exhibit similar patterns. Beef prices were relatively high from 1950 to 1952 and depressed from 1953 to 1957. They rallied from 1958 to 1962, but never reached early 1950 levels. A moderate depression occurred between 1963 and 1965 but the drop was less than in the mid-1950's. Beef prices rose again beginning in 1966.

Increases in beef cattle production have also been made possible by the decline in milk cow numbers, which resulted from lower per capita consumption of dairy products and increased productivity per cow. Further, the growing importance of part-time farming favors an enterprise, such as beef, that can be managed on a labor-extensive basis.

Increases in the average size of farm can also be hypothesized as important to the emergence of beef cow herds and a larger beef cow inventory. As farms consolidate, fragmented holdings of pasture are brought under one management, which makes it possible to support a viable beef cow enterprise.

Finally, the Federal commodity and conservation programs operating over the last two decades probably tended to encourage beef cattle enterprises. Allotments and other controls on the acreages of major crops, together with the acreage diversion aspects of these programs, created an "idle" land resource. Often, the conservation of these land resources, diverted from crop

production, meant that they could be used for pasture or roughage crops suitable for beef cattle feed. Although the programs did not permit grazing during the growing season, crops could be established which provided winter pasture for livestock. In addition, programs such as the Conservation Reserve in the 1950's and the Great Plains Conservation Program of the 1960's provided an incentive to shift croplands to grass or to improve the productivity of established pastures. The conservation reserve programs shifted large acreages of cropland to conserving uses--often permanent pasture. These resources became available for establishing or adding to a beef cow herd.

FUTURE SUPPLIES OF BEEF CATTLE

The beef cattle industry in the United States seems near the end of one major phase of its development. Nearly complete is the expansion of beef production through grain feeding of more young cattle to slaughter weights of 1,000 to 1,100 pounds rather than slaughtering them as calves or lightweight animals off pasture. Many possibilities exist for obtaining the greater quantities of beef that consumers are expected to demand, but changes in domestic cattle raising seem basic to any significant increase. These changes will be important to the agriculture of nearly every State, to all consumers, and to the economy as a whole. Knowledge of both probable and potential changes is necessary for orderly guidance of change throughout the beef industry from individual producer to public policy levels. Concentrating research in the most productive areas is essential.

Estimating Production Probabilities

Economists have used many analytical techniques for estimating future production possibilities; methods have ranged from simple extension of trends in time series data to rigorous development of constrained optimizing models. Such intensive studies provide measurements of change and evaluation of the effects of factors involved. But none of them offer the combination of simplicity, speed, and contact with reality that can be achieved by obtaining information directly from the persons who will be largely responsible for effecting changes.

Many nonfarm industries have long made use of expert opinion as one of their gauges of the future. Persons in leadership and decisionmaking positions can usually interpret developing situations the most accurately. Their actions subsequently lend substantial strength to the outcome that they have predicted. Further, they have knowledge of developing situations not reflected in historical data.

A method called the Delphi process is available for obtaining expert opinion (1). Basically, it involves selecting a panel of experts who are to remain anonymous to each other. Questions are posed to the panel members. Responses are summarized and fed back to the members who are given the opportunity to adjust their initial responses and offer reasons for their initial positions and adjustments. The feedback and adjustment process is continued until the response of the group is stabilized.

During the summer of 1971, the Delphi process was used to obtain the opinions of persons with intimate knowledge of the cattle-raising industry. All regions of the United States were included except the Northeast where beef cattle raising is of minor importance (fig. 1).

First, a list of experts was compiled for each State. 4/ These experts were in positions of leadership or decisionmaking with respect to the future of cattle raising in their States. Occupations included: State and area extension specialists in beef, milk, and forage production; farm management specialists at both the academic and operating levels; livestock marketing specialists; directors of State beef cattle associations; persons from financial institutions; and leading cattle producers.

At the outset, the panel of experts included 565 persons, an average of 15 per State. Some of the larger States with varied resources and climate were divided into parts and a panel was selected for each.

A questionnaire was sent which asked for quantitative estimates for the expert's State or substate area of beef and milk cow inventories, calving percentages, size distribution of beef herds, weights of calves and cull cows, and disposition of dairy calves for 1975 and 1980. The most recent data available were provided in the questionnaire as a foundation. In addition, the experts were to make estimates in the light of projected 1975 and 1980 prices for selected farm products, prices which were provided with the questionnaire (table 14). Further, the experts were asked to identify and estimate the relative importance and expected level of adoption or occurrence of factors affecting productivity per cow and factors affecting the number of cows that would be kept.

First-round responses were summarized by States and regions. Each respondent received a copy of the summary for his State and region and his original questionnaire, and he was permitted to adjust his original estimates, giving reasons for any change.

Initial responses were accepted as final for the Northern Plains, Mountain, and Pacific regions because of slow and partial return of questionnaires. Estimates were finalized with the second-round responses in the other regions as rather minor changes were made by many respondents, especially those whose first-round estimates fell within the interquartile

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4/ This list was compiled by the resident agricultural economists, FPED, ERS, at field stations or by staff members of the State agricultural colleges.

Table 14--Prices received by farmers for specified commodities, selected years and projected 1975 and 1980 1/

Commodity	Unit	Price per unit in--									
		1947-49	1957-59	1965	1966	1967	1968	1969	1967-69	1975	1980
		Dollars									
Wheat	Bushel	2.05	1.81	1.35	1.63	1.39	1.24	1.24	1.29	1.20	1.20
Corn	do.	1.56	1.09	1.16	1.24	1.03	1.08	1.12	1.08	1.00	1.00
Sorghum grain	do.	1.41	0.943	0.99	1.02	0.99	0.95	1.06	1.00	0.92	0.92
Barley	do.	1.32	.882	1.02	1.05	1.00	.911	0.877	0.929	.85	.85
Oats	do.	0.804	.610	.622	0.665	.659	.598	.581	.613	.57	.57
Soybeans	do.	2.59	2.01	2.54	2.75	2.49	2.43	2.33	2.42	2.35	2.35
Cattle and calves	Cwt.	20.30	20.78	20.05	22.47	22.58	23.69	26.57	24.28	26.00	28.50
Hogs	do.	21.77	17.17	20.60	22.80	18.90	18.70	23.00	20.20	21.00	22.00
Milk	do.	4.37	4.17	4.23	4.81	5.01	5.24	5.46	5.24	6.50	7.50

1/ Prices provided the panel of experts as part of the basis for making their original estimates.

range of all estimates for the State. 5/ Ultimately, completed first- or second-round responses were received from 295 experts as follows: Corn Belt--42; Lake States--36; Southeast--120; Southwest--42; Northern Plains--21; Mountain--17; and Pacific--17.

Results of the survey, although not a true test of the Delphi process, did provide an immediate set of quantitative estimates. For the most part, they stand the test of "reasonableness" and give a framework of reasons for changes, both past and future, which is not available from any other source or analytical method. The quantitative estimates represent a base point for further evaluation, and the factors identified as both important and relevant to shifting of both numbers and production per unit will facilitate further research and perhaps enlighten present leaders and decisionmakers.

Survey Results

Data presented in the first part of this report show that 1950-70 resulted in a reversal of the ratio of beef-to-dairy cows, an expansion in the national beef cow inventory of a million head a year, and a decline in the milk cow inventory of half a million a year. By 1970, the combined beef-milk cow inventory stood at 51 million head--nearly 11 million above the 1950 count--with beef cows outnumbering milk cows nearly 3 to 1.

In the opinion of the experts, these trends will continue through the 1970's but at a slower pace than during the 1950's and 1960's. Great differences in adjustments are expected among regions, and many factors will influence the anticipated changes.

Projections of Beef Cow Numbers

The median estimates of expert opinion of future beef cow inventories totaled 41.7 million cows for 1975 and 46.3 million for 1980 (table 15). These are 12 and 24 percent, respectively, above the number on farms and ranches in 1970. They represent an average annual increase over the 10-year period of about 900,000 head, or 100,000 less than the average increase from 1950 to 1970.

5/ The length and complexity of the questionnaire used in this study probably reduced the productivity of subsequent adjustment rounds as prescribed in the Delphi process. Performance could have been increased with fewer questions and a more readily accessible panel of experts. These possibilities should be explored in future applications of the Delphi process. However, the researchers in this study concluded that information gained through intensive questioning outweighed the possible loss from failure to achieve adjustment beyond the second round of responses.

Table 15--Beef cows and heifers 2 years old and over on farms, by States and regions, 1970 and projected 1975 and 1980

State and region	1970 1/	1975 2/	1980 2/	Change from 1970 to--	
				1975	1980
	Thousands			Percent	
Northeast 3/	258	258	258	0	0
Ohio	360	400	450	11	25
Indiana	439	490	550	12	25
Illinois	744	819	912	10	23
Missouri	1,929	2,400	2,600	24	35
Iowa	1,443	1,800	2,200	25	52
Corn Belt	4,915	5,909	6,712	20	37
Minnesota	545	665	815	22	50
Wisconsin	239	290	362	21	51
Michigan	123	147	170	20	38
Lake States	907	1,102	1,347	21	49
North Dakota	964	1,137	1,323	18	37
South Dakota	1,719	1,940	2,180	13	27
Nebraska	1,888	2,204	2,623	17	39
Kansas	1,839	2,140	2,387	16	30
Northern Plains	6,410	7,421	8,513	16	33
Virginia	499	550	587	10	18
West Virginia	207	220	242	6	17
North Carolina	371	425	500	15	35
South Carolina	266	300	340	13	28
Georgia	830	900	980	8	18
Florida	909	977	1,053	7	16
Kentucky	1,087	1,310	1,637	21	51
Tennessee	954	1,092	1,250	14	31
Alabama	929	1,029	1,200	11	29
Mississippi	1,273	1,464	1,684	15	32
Arkansas	939	1,085	1,195	16	27
Louisiana	903	990	1,150	10	27
Southeast	9,167	10,342	11,818	13	29
Arizona	376	380	391	1	4
New Mexico	708	710	769	0	9
Oklahoma	2,174	2,311	2,526	6	16
Texas	5,737	5,928	6,059	3	6
Southwest	8,995	9,329	9,745	4	8
Idaho	588	650	725	11	23
Montana	1,589	1,730	1,950	9	23
Wyoming	737	835	941	13	28
Colorado	1,082	1,250	1,350	16	25
Utah	351	385	386	10	10
Nevada 3/	336	336	336	0	0
Mountain	4,683	5,186	5,688	11	21
Washington	373	390	420	5	13
Oregon	685	730	750	7	9
California	946	1,000	1,025	6	8
Pacific	2,004	2,120	2,195	6	10
48 States	37,339	41,667	46,276	12	24

1/ Number on hand January 1; (8).
2/ Based on estimates from survey of expert opinions.
3/ No survey made in Northeast or Nevada. Numbers assumed constant at 1970 level.

The interquartile range of these estimates shows that there was a relatively high degree of consistency among the experts. In States for which this measure was available, the middle half of the 1975 estimates varied less than 5 percent above or below the median of all estimates (table 31). For the 1980 estimates, the interquartile range was from 8.3 percent below the median estimate to 7.4 percent above.

Results of the survey indicate that the number of beef cows is expected to increase in all States and regions except the Northeast, for which no estimates were made. However, great differences among States and regions are predicted in both relative and absolute growth. Generally, the largest relative growth is expected in the humid regions, where crop-livestock farms are dominant, and in those crop farming areas of regions where ranching is the major type of agriculture.

Corn Belt

The Corn Belt is expected to increase its beef cow inventory 20 percent over the 1970 count by 1975 and 37 percent by 1980. Growth will come largely through more intensive use of resources and expansion of cow-calf enterprises on farms that already carry beef cow herds. Major factors behind this optimistic outlook include an expectation of favorable prices for feeder calves, combined with relatively low grain prices; a shortage of feeder cattle within the region; a strong forage production potential; problems of waste management with cattle feeding and hog production; and further enlargement of both farms and beef cow enterprises. The supplementary characteristics of the beef cow enterprise are expected to remain strong; for example, part-time farmers will make a significant contribution to beef production.

Within the Corn Belt, the lowest rate of increase in beef cow numbers is predicted in Illinois, chiefly because of its high proportion of good land and intensive row crop farming. The projection for Indiana is similar. Both Missouri and Iowa are expected to add to their already large beef cow inventories--over 1.4 million beef cows by 1980, or 80 percent of the total increase projected for the Corn Belt.

Lake States

Growth in the Lake States will probably approximate a half-million cows by 1980; gains will be greater in Wisconsin and Minnesota than in Michigan, both relatively and absolutely. The comparatively bright future that most experts envision for dairying prevented them from projecting more of an expansion in beef cattle raising. The production potential for grass-legume forages and the continuing shift out of dairy production seem relatively more important in the Lake States than in the Corn Belt. Otherwise, reasons for expansion in beef cattle raising in the two regions are much the same.

Southeast

The Southeast is expected to continue enlarging its beef cow inventory, but at a slower pace than in earlier years. From a total of about 9.2 million beef cows in 1970, numbers should expand to 10.3 million by 1975 and 11.8 million by 1980. This addition of 2.6 million cows represents about 30 percent of the growth expected nationally. Yet it falls below the more than 3 million beef cows added during the 1950's and the similar amount in the 1960's.

The median estimates in only two Southeastern States--Alabama and Louisiana--indicate larger absolute increases in beef cow inventories during 1970-80 than 1960-70. In none of the States is the percentage increase in the 1970's expected to be as large as that in the last decade. Also, because the anticipated addition in each State is roughly proportional to the size of the State's 1970 inventory, little change from the 1970 percentage distribution by States is expected. Kentucky is projected to have 2 percent more of the regional total in 1980 than in 1970; for Florida, the figure is 1 percent less than its 1970 share. In no other southeastern State is the proportion of the total inventory in 1980 expected to differ from that of 1970 by as much as 1 percentage point.

Generally, the factors responsible for past growth will continue influencing expansion in the Southeast. These include reduced acreages of cotton and tobacco, more specialization in farming, farm consolidation, increasingly scarce and costly farm labor, technological improvements in forage production and utilization, and a continuing trend toward part-time farming. Beef cow numbers will rise at a slower rate. The extent of past growth plus rising land costs, shifts of land to nonfarm uses, and increases in calf grow-out and grain-on-grass cattle-feeding activities are given as major factors.

Northern Plains

The Northern Plains region is expected to add about a million beef cows by 1975 and another million by 1980. The increase over 1970 is 16 percent by 1975 and 33 percent by 1980. Changes will differ little among the four States.

Most of the expansion is marked for the crop farming areas in the eastern half or third of the Northern Plains. Improvement in the production and utilization of forage crops is expected to affect significantly the increase of cattle raising. Shifts in land use from grain to forage production is also thought important in raising cow numbers. Several dissenting opinions, however, were expressed about the likelihood of shifts in land use.

Southwest

Rates of expansion in the Western States drop far below those expected in the eastern half of the United States, partly because of the large initial base and specialization in cattle raising, and partly because of a limited potential for more production. The inventory of beef cows in the Southwest

region is expected to increase over the 1970 level less than 4 percent by 1975 and 8 percent by 1980. The median estimate is 9.3 million head by 1975 and 9.7 million head by 1980. A higher absolute and percentage increase is expected in Oklahoma than in the other three States. Texas, with the largest number of cows, may have almost as much absolute but a smaller percentage increase. Arizona and New Mexico, with the smallest proportions of the region's beef cows, are estimated to have only a slight increase by 1975, although New Mexico's gain in numbers could be nearly 9 percent by 1980.

Gains will come largely from improvement of forage production and expansion of cattle raising in the cropping areas of these States, especially along the Gulf Coast and the southeastern part of Texas. A shift from sheep and goat production will allow some growth in the range areas, but overgrazing and transfer of grazing lands to other uses will reduce the number of beef cows in some areas.

Mountain States

Experts in the Mountain region expect cow numbers to increase at about the same rate as for the Nation as a whole--11 percent by 1975 and 21 percent by 1980. Little change is anticipated in Utah and Nevada because of the arid climate and full utilization of existing forages. Increases in other States will come partly from technological advances in forage production on rangelands. However, as in all other regions, the crop farming sections will account for most of the gains.

Pacific

The Pacific region will add about 0.2 million beef cows by 1980, with modest increases occurring in all States. Competing land uses will contain area expansion of cow herds in the cropping areas and the rangelands have the same limitations as in other Western States.

Projected Milk Cow Numbers

Dairying, through cull cows, veal calves, and feeder calves, contributes in a substantial though declining way to the total supply of beef. Thus, estimates were made for numbers of milk cows expected in 1975 and 1980. 6/

6/ It should be recognized that the experts were selected primarily because of their knowledge of beef cattle raising rather than milk production. Not more than 10 percent of all respondents could be classified as specialists in dairying yet all were encouraged to provide estimates on milk cow numbers. Most did so, but many commented that their knowledge of dairying was limited. Therefore, the estimates presented and discussed in this section may be less reliable than those for beef cattle, as suggested by the greater spread in the interquartile ranges (table 32). Nevertheless, the generalizations that can be drawn from the estimates are of value.

Milk cow numbers are expected to continue declining in all regions, but at a much slower rate than in the past. The median estimate was 12.7 million milk cows in 1975 and 12.1 million in 1980, compared with 13.9 million in 1970 (table 16). The average annual decline is therefore about 175,000 head, compared with one of more than 500,000 a year between 1950 and 1970. 7/

Most respondents believe that milk cow numbers have dropped sufficiently to maintain reasonably profitable milk prices. A leveling of milk cow numbers by 1980 seemed implicit in the experts' remarks. Barring further increases in the use of milk substitutes by 1980, the change in milk cow numbers will probably become a function of changes in regional population. A combination of declining per capita consumption of milk and increased production per cow is responsible for this expected trend.

Within the regions where dairying has been important, the estimates suggest a concentration of production in the States best suited to dairying. Milk transportation is less of a problem today, as can be noted in the Northeast and Southeast. States with a rapidly growing population, such as Florida, expect to stabilize milk cow numbers rather quickly and may eventually have to increase them if institutional constraints continue to bar importation of milk. Most Western States, except those in the Pacific region, struck a balance between milk production and population in earlier years. Only minor adjustments are expected in the next decade.

Expected declines in numbers of milk cows will not offset increases in beef cows in any region except the Pacific, where the combined inventories of beef and milk cows in 1980 will equal those of 1970. In all other regions, (except the Northeast, where no beef cow estimates were made), expected gains in beef cows far outweigh predicted losses in milk cows. The combined national inventory of beef and milk cows should rise from 51.2 million in 1970 to 54.4 million in 1975 and 58.4 million in 1980. However, only a fifth of all cows will be milk cows in 1980 compared with three-fifths in 1950. Hence, dairying will be much less important as a contributor to the beef supply.

FACTORS INFLUENCING THE NUMBER OF BEEF COWS

As discussed, beef cow numbers are expected to grow substantially between 1970 and 1980. A rather high degree of agreement on this point existed among the experts. The influencing factors and their relative importance are less certain. Nevertheless, expert opinion again serves both a discovery and evaluation function. The pertinent factors mentioned in sections on regional estimates are reexamined here in greater depth.

7/ Analysis of individual responses reveals that dairy specialists gave estimates equivalent to only 90 percent of the median value of the estimates of dairy cows by all respondents. Though all responses are used to indicate trends and relationships among States and regions, the absolute values provided by the dairy specialists may be the more accurate here.

Table 16--Milk cows 2 years old and over on farms, by States and regions, 1970 and projected 1975 and 1980

State and region	1970 1/	1975 2/	1980 2/	Change from 1970 to--	
				1975	1980
	Thousands			Percent	
Maine	77	66	59	-14	-23
New Hampshire	43	38	34	-12	-21
Vermont	230	208	189	-10	-18
Massachusetts	72	60	50	-17	-31
Rhode Island	8	6	5	-25	-37
Connecticut	74	54	46	-27	-38
New York	1,127	1,050	980	- 7	-13
New Jersey	80	60	45	-25	-44
Pennsylvania	807	730	660	-10	-18
Delaware	16	13	10	-19	-37
Maryland	182	175	165	- 4	- 9
Northeast 3/	2,716	2,460	2,243	- 9	-17
Ohio	493	450	450	- 9	- 9
Indiana	270	250	225	- 7	-17
Illinois	359	322	300	-10	-16
Missouri	400	350	325	-12	-19
Iowa	568	500	500	-12	-12
Corn Belt	2,090	1,872	1,800	-10	-14
Minnesota	1,089	952	900	-13	-17
Wisconsin	2,062	2,000	2,000	- 3	- 3
Michigan	509	455	420	-11	-17
Lake States	3,660	3,407	3,320	- 7	- 9
North Dakota	163	161	176	- 1	8
South Dakota	200	160	143	-20	-28
Nebraska	211	188	175	-11	-17
Kansas	224	205	175	- 8	-22
Northern Plains	798	714	669	-11	-16
Virginia	245	217	193	-11	-21
West Virginia	69	65	60	- 6	-13
North Carolina	207	185	182	-11	-12
South Carolina	74	70	65	- 5	-12
Georgia	152	150	149	- 1	- 2
Florida	199	196	197	- 2	- 1
Kentucky	388	367	352	- 5	- 9
Tennessee	345	305	295	-12	-14
Alabama	151	142	147	- 6	- 3
Mississippi	224	200	195	-11	-13
Arkansas	106	100	90	- 6	-15
Louisiana	196	176	160	-10	-18
Southeast	2,356	2,173	2,085	- 8	-12
Arizona	54	54	53	0	- 2
New Mexico	39	39	38	0	- 3
Oklahoma	161	153	141	- 5	-12
Texas	381	363	354	- 5	- 7
Southwest	635	609	586	- 4	- 8

See footnotes at end of table.

Continued

Table 16--Milk cows 2 years old and over on farms, by States and regions, 1970 and projected 1975 and 1980--Continued

State and region	1970 1/	1975 2/	1980 2/	Change from 1970 to--	
				1975	1980
	Thousands			Percent	
Idaho	169	165	162	- 2	- 4
Montana	47	44	41	- 6	-13
Wyoming	20	16	12	-20	-40
Colorado	112	112	112	0	0
Utah	82	85	88	4	7
Nevada	15	15	15	0	0
Mountain	445	437	430	- 2	- 3
Washington	200	185	168	- 7	-16
Oregon	118	112	103	- 5	-13
California	840	776	711	- 8	-15
Pacific	1,158	1,073	982	- 7	-15
48 States	13,858	12,745	12,115	- 8	-13

1/ Number on hand January 1; (8).
2/ Based on estimates from survey of expert opinions.
3/ Projections for Northeast prepared by G. E. Frick, Agricultural Economist, FPED, ERS, stationed in New Hampshire.

Shifts in Crop Production

Traditionally, land unsuited for any crops more profitable than pasture and hay has been used for beef cows. This condition should continue through the 1970's, but forces exist that will both add to and detract from the land that can be profitably devoted to beef cow operations.

Forage and Grains

Applied forage production technology is in its infancy in the more humid regions of the country, at least compared with row crop technology. Forage crops produced with known technology could compete with grain production in many places. Techniques designed for more intensive cultivation of the less productive lands also continue to advance the relative position of forage production.

Especially in the Corn Belt and Lake States, farmers favor grain farming and are expected to continue to do so. Higher yield potential for corn and soybeans in these regions will block any significant encroachment by forage crops on land suited to row crop production and may take some land now producing forage. Only occasional producers are expected to specialize in cattle raising.

The tradeoff between small grains and forage production seems more uncertain. Most of the Northern Plains experts foresee that the expected shift from small grain to forage production will be a major force leading to increases in cattle raising. They anticipate lower long-term prices for wheat and feed grains relative to prices for feeder cattle. A minority argue strongly, however, that oats, which has the lowest profit potential, will prove superior to forages, given the same level of managerial proficiency.

Cotton and Tobacco

Reductions in cotton and tobacco acreages are expected to continue on many farms in the Southeast and an increasingly large proportion of these crops will be grown on fewer and larger farms. Forage for beef cows will be grown on some of the released cropland, but the potential for soybeans and newly introduced cultural practices for raising corn will act as a counter force. Further, many farmers will be compelled to seek a more intensive use than forage production for their cropland to meet minimum needs for income.

Nonfarm Uses of Land

Nonfarm interests are expected to step up demands for grazing lands. In the more densely populated areas of the Corn Belt, Lake States, and Southeast, farmland is being increasingly converted to industrial, residential, and recreational uses. Recreation enterprises are also expected to take over grazing lands in the range areas of the West. Not only do such shifts in land

use reduce the potential for cattle raising, but subsequent increases in land prices and real estate taxes may also push the costs of some grazing lands beyond the level that cattle raisers can afford.

Farm Operators

Changes in the farm population and the consequent shift in land use patterns may well be one of the stronger forces favoring expansion of cattle raising, especially in the eastern half of the country. Several factors are involved, but the increasing average age of all farmers and the growth of part-time farming seem most important. Many farmers, including those with highly productive lands, choose to retire gradually by shifting to less labor-intensive enterprises. Beef cow herds are often the choice. The rising cost and scarcity of hired labor are added incentives to make such a shift. More part-time cattle farming thus seems probable. However, there is little information about such farming, and only the direction of future change can be suggested. Consolidation of small, fragmented holdings--to the extent it can be achieved--can facilitate cattle raising and would be especially useful in areas where pastures make up a significant part of total land.

Shifts in Livestock Enterprises

Dairy

Changes are expected in livestock enterprises that will affect the number of beef cows that can be kept. They already occupy much of the land formerly used by milk cows, particularly in the humid regions. Though this shift will continue, most experts consider that the dairy inventory will begin to level off and that few additional land resources will be freed for use by beef cows during the 1970's. However, more dairy enterprises will be moved into year-round confinement that utilizes only harvested feeds, thus freeing some permanent pastures. In the western half of the country, opportunities for shift are inconsequential as dairying is already minimal and relatively stable.

Sheep

Nationally, beef cows have been substituted for sheep over the years. Experts expect further declines in sheep in all regions, but this shift is nearly complete in the eastern half of the country. For example, the 12 States in the Southeast now have fewer sheep than Kentucky alone had in 1950.

In the Southwest, where sheep remain very important, the experts foresee serious difficulty in the industry because of the increasing cost and scarcity of labor, low wool prices, and relatively high feeder cattle prices. Recent loss of the use of poisons for predator control has aggravated the situation. Unless these conditions change, the experts predict a wholesale conversion from sheep to beef cattle raising, except on lands suited only for sheep.

Declines in ewe numbers by 1980 are projected at 8 percent for Arizona, 23 percent for New Mexico, and 14 percent for Texas. (Estimates were not obtained for Nevada.) Expectations for the Mountain region are similar.

Beef

Changes within the beef cattle industry itself may affect numbers of beef cows more than changes in other livestock enterprises. Traditionally, few beef cattle systems have been strictly cow-calf operations. Some cow-calf units sell some calves and hold the remainder over for sale as short or long yearlings, depending on the forage supply. Other units buy additional calves and sell them as yearlings. Or they sell few, if any, of their cattle as calves, preferring to feed them to slaughter weight. Some beef cattle operations buy and sell only stocker cattle. The future direction of these production systems will have major significance on the number of feeder calves that go into feedlots. Once weaned, a calf competes with beef cows for feed and forage and consequently acts as a constraint on production of additional calves.

Some change in cattle-raising systems is anticipated in most regions. The cattleman in the Corn Belt has traditionally either sold calves or fed out those raised in his own small feedlot. The finishing phase of such operations has been relatively unprofitable, so more farmers are expected to discontinue their feedlot operations, emphasize the cow-calf enterprise, and push for heavier calves to increase returns. Resources thus freed may well hold the greatest single potential for increased feeder cattle production in this region. Possibilities here warrant closer study.

Different adjustments appear likely in the Southeast. There, the experts anticipate increases in calf grow-out and grain-on-grass cattle-feeding activities. Expansion in beef cow numbers may thus be curtailed.

Southwestern producers engage in three distinct cattle-raising programs--cow-calf, cow-yearling, and yearling-stocker. Programs in Arizona should stay relatively unchanged throughout the 1970's; the cow-calf system will remain dominant and yearling-stocker programs will fluctuate with the feed supply. Despite an anticipated increase in demand from feedlots for feeder calves, cow-calf systems are expected to decline in the other Southwest States. They will be replaced primarily with cow-yearling programs in Texas and New Mexico and yearling-stocker programs in Oklahoma, where considerable wheat grazing is available.

Some, though not many, stocker and cow-yearling programs will shift to cow-calf systems in the Northern Plains. Thus, the region could carry more beef cows, but not that many more. No significant change is expected in the Mountain and Pacific regions.

Except in the Corn Belt and Northern Plains, these shifts in cattle-raising systems are expected to put pressure on resources that can be used to maintain beef cow herds. Thus, though more beef calves will be needed to go into feedlots, producers apparently want to capture the returns from additional

gains on the calves they produce, rather than raise more calves. Further movement in this direction is definitely likely in areas close to concentrations of large feedlots. In fact, farmers and ranchers may establish warmup systems for the feedlots. On the other hand, a shortage of calves and hence, favorable prices for them, would cause producers to concentrate on calf production. Shifts among cattle-raising systems probably allow more flexibility in cow numbers than shifts in land use. Any analysis of future feeder-cattle supply probabilities will have to reckon with these options in cattle raising.

Forage Production, Harvesting, and Utilization

Nearly all the experts listed improvements in forage production as a strong factor determining future numbers of beef cows. In the ranching areas, the ranges are now fully stocked and sometimes overgrazed, and future cow numbers will be a direct function of the feed supply. Apparently, much forage now produced in the Corn Belt and Lake States is under utilized. Most of the experts stated that applying output-increasing technologies to forage production would have a positive effect on the number of cows kept.

Technology

For forage technology, fertilization of pasture and hay crops, improved selection of forage plant mixes, controlled grazing, renovation and reseeding of existing pastures and ranges, and use of herbicides to control undesirable plants are emphasized. Irrigation of forage crops is strongly recommended for some of the Western dryland areas, but is not considered relevant in the eastern half of the country.

By 1980, farmers are expected to make considerable use of fertilization and variety selections. The intensive management practices already applied to row crops are likely to carry over into forage production as it becomes more profitable to do so.

Drought

Drought as a limiting factor in forage production was uppermost to many experts, especially those in the Southwest. There, rainfall is the major constraint and affects the number of cows that can be maintained. Enough rainfall was also considered important in the humid regions, where beef cows are normally kept on the thinner, nontillable lands. Numbers are limited to the pasture available in the driest part of the summer unless a program of harvesting and feeding is established. This setup is costly for operators with small herds and competes for labor with other crop operations. Increased herd size and selection of more adapted plant varieties offer a partial solution, perhaps in conjunction with more intensive cow herd management systems.

Hay, Silage, and Crop Residues

Beef cow expansion will be encouraged by developments that cut costs and permit more and better quality hay; improvements in methods of salvaging crop residues, especially from corn; and storage of more grass-legume crops and corn as silage. The positive value of silage, however, is questioned and its relative importance to beef cow expansion is rated medium to low. The potential value of silage to the small-volume producer remains extremely low because of equipment and storage costs.

Opinions were mixed in the Corn Belt and Lake States concerning the likelihood that farmers will use more of their forage as silage. Reasons for nonuse are apparent in small operations, but less so in large ones. Respondents in the Northern Plains rate a shift from hay to silage as a very low probability. Much of what happens will depend on developing technology and the associated change in labor needs in forage harvesting and handling.

The harvesting and feeding of corn crop residues, such as "husklage" or "stalklage," have received much publicity in recent years. Certainly, the potential supply of feed from this source is enormous. Again, respondent reaction about the level of adoption of this practice by 1980 was mixed, but leaned toward only a moderate level for operators of both small and large herds. Continued research on the problems and potentials of feeding corn residues seems desirable.

Mechanization

Mechanization of feed processing and distribution increases the capacity of farmers to handle cows, but such mechanization seems likely to remain relatively low, especially on farms with fewer than 50 cows. High-forage rations, which are basic to cow-calf systems, add to the difficulty of using mechanical aids in feeding, regardless of volume.

Public Policies and Institutions

The experts from all regions expressed concern regarding future public policies and institutions that might affect cattle raising but most believed that public policy would tend to favor expansion.

Crop Programs

Future supply-control programs for crops, especially feed grains and wheat, are expected to affect cattle numbers. Most experts believed that policies will be directed toward keeping the prices of these grains relatively low, hence closing or reversing the competitive gap between forage and grain production in some areas. Also, public pressure may force changes in Government programs to permit grazing or harvesting the forage from the 50 to 60 million acres of cropland idled annually by feed grain and wheat diversion programs, especially if the price of beef moves strongly upward. The

scattered, small, unfenced tracts of set-aside land typical of midwestern grain farming operations would make effective grazing use of such land difficult, however. Special incentives to shift cropland to forage production, perhaps on a whole-farm basis, would be likely to have much greater impact.

Drugs

Regulations or policies with respect to the use of diethylstilbestrol (DES), melengestrol acetate (MGA), estrus control chemicals, antibiotics, and other synthetic materials affecting animal health, growth rate, feed efficiency, or reproductive performance will affect cattle raising. Use or nonuse of such materials can influence cost of production, productivity per animal, death rates, and the efficiency of current beef production. Much of the impact of any withdrawal of these materials from use may occur initially at the feedlot level, but will eventually spread to all phases of cattle raising. Reduced use of chemicals and drugs could adversely affect returns from beef production relative to those from other crop and livestock enterprises. If the beef supply is thus reduced, the effect on the price of beef would be an important consideration. Little is known about the economic importance of synthetic materials in either cattle raising or feeding.

Environmental Quality

The increasing emphasis on environmental quality and ecology is expected to work both for and against expansion of beef cow numbers. The impact will probably differ among regions. For example, grazing of public lands is expected to be controlled more rigorously to lessen damage to the ecological system and to accomodate the constantly growing demands for outdoor recreational areas. Increases in grazing fees, less intensive stocking allowances, and outright removal of some public lands from grazing are all possibilities. Land use policy, or perhaps the lack of a strong policy, and multiple use demands on public lands will be major considerations in the future. For example, land use policies could be instituted that would shift the economic advantage of cattle raising from one region to another.

Use of chemicals will also be more controlled. In particular, herbicides used to eradicate undesirable plants on rangelands would be restricted whenever their use might adversely affect the wildlife population. Such regulation could reduce the productive capacity of ranching in some parts of the West.

The present ban on poisons used to control predators might affect production in the range areas. Predators destroy more sheep than cattle; thus any adverse affects from the ban on poisons would be greater on sheep ranching. As a result, beef cattle numbers would expand.

Regulations of business methods used by crop-livestock farmers in the more humid regions may also be tightened. The use of commercial fertilizers, especially inorganic nitrogen, is now being reviewed and regulations of

quantities and application methods are possible. Pressure to reduce soil erosion from both wind and water is increasing. Coupling regulations in these areas with more controls on pesticide use may be more of a deterrent to row crops than forage production, and hence encourage expansion of cattle raising. Certainly, these issues aroused mixed opinions among the experts and warrant careful consideration by researchers, policymakers, and legislators.

Livestock Wastes

The problem of managing livestock wastes was another concern of the experts, especially those in the humid regions. Most noted was the proliferation of Federal, State, and local rules, regulations, and laws about control of odors, runoff, nitrates in the ground water, and other aspects of environmental quality. Differences between authorities can affect the comparative advantage of cattle raising both within a region and between regions. Cattle raising is usually a more extensive operation than cattle feeding or hog production, which are both intensive operations. Thus, the experts agreed that cattle raising would be least affected and perhaps encouraged by pollution control. Nevertheless, laws such as those requiring that livestock be fenced away from all streams could have a substantial negative force. Further, the system of confining beef cow herds closely will be confronted with the same constraints as other intensive livestock systems. Admittedly, few of the facts relating to pollution or its control are known for any system of livestock production.

Income Tax Regulations

Federal income tax regulations provide an incentive to own beef cows, especially for investors in high tax brackets because of rapid depreciation allowances and possibly, investment credit. Further, some experts noted that the tax shelter possibilities encourage outside investment from persons with access to large amounts of capital even in the areas that traditionally have family farms. Increased use of these favorable tax regulations could result in rapid increases in the price of breeding stock, perhaps to the detriment of the average cattle raiser. As a result, production of feeder animals might be curtailed.

Imports and Exports

Import-export policies also generated some concern among the experts. On the one hand, they saw imports of fresh and processed beef competing with domestic beef, especially processing beef from cull breeding stock. The continually growing influence of consumers on legislation affecting imports was recognized. On the other hand, there is the possibility of more promotional programs to market grain-fed American beef in high-income foreign countries.

Beef Grades

The present system of Government grades for beef may be less flexible than desirable. Though the system will probably help maintain the superior image of beef, it might also retard change that could strengthen the industry.

Statistics show that per capita consumption of beef rose from 64 pounds in 1950 to 114 pounds in 1970. 8/ The percentage of grain-fed cattle rose nearly 30 points over these 20 years, and choice slaughter cattle increased about 20 percentage points. The proportion of fat-to-lean has obviously increased. Further, some consumers are not eating as much more beef as the data suggest. Producing fatter cattle requires much more feed energy than does production of lean animals. Also, the fat that is salvaged in processing is worth only a few cents a pound; much is recycled into livestock feed.

Present grades emphasize marbling and yield. There is no direct means for recognizing a high quality of lean beef. Aversion of some consumers to excessive fat suggests possibilities for reducing grain-feeding programs and adding grades for the new products. Perhaps grades such as "Young Lean" or "Tender Lean" would encourage more beef consumption. Or modifications could be made within the current grades. Consumers are concerned with excess fat in terms of waste and cholesterol problems and with chemical residues as evidenced by the increasing attention to so-called "organic beef." Thus, further review of consumer preferences and grading standards may be necessary. Any change in these would be of great significance to cattle raisers.

Substitutes for Beef

Beef is not expected to receive increased competition from pork or other meats. This result is not surprising, as beef has gained steadily in consumer acceptance relative to other meats. Unless incomes fall, there is little reason to expect a reversal of this trend. Few experts mentioned the possible encroachment of plant proteins or synthetic meat either.

Much beef, especially that from cull and dairy cows, goes into processed beef products. Here, the issue of other protein sources becomes more substantive. Also, the effect of public policy--through regulation of food content--becomes important. Current public standards allow beef products to be extended by a specified amount with soybean and other proteins. If consumer acceptance is achieved and costs are lowered, extenders seem likely to be used in increasing amounts. As food technology is advancing rapidly, further developments can be expected.

8/ These data were derived by dividing carcass weight equivalents of slaughtered cattle by population. No allowance was made for variations in the unused fat on the carcass.

Policies on allowable contents of beef products will affect cattlemen, though not necessarily adversely, even if substantial amounts of other products are permitted. Perhaps experiences from the butter and oleomargerine conflict contain lessons for the beef industry. The issue deserves careful study.

Public Investment

Some experts noted that the level of public investment in all phases of beef production would be important. Specifically mentioned were expenditures for improvement of forage production on public lands and for research generally.

Cattle Prices

The experts made their estimates under the assumption that the average price for all cattle and calves would be $26 per 100 pounds in 1975 and $28.50 in 1980. Historically, choice grade slaughter cattle have commonly sold for around $3.50 to $4 above this weighted average all-cattle price. Because negative price margins of $4 to $6 per 100 pounds are expected to prevail between the prices of choice slaughter steers and choice feeder calves, the estimates of future cow numbers were made under the assumption that choice steer calves would be priced around $34 to $35 in 1975 and $37 to $38 in 1980.

These future prices favor production of feeder cattle relatively more than in past years (table 14). However, most experts generally agreed that this situation will occur. Anticipation of favorable prices for feeder cattle over the next 10 years was one of the strongest reasons for projecting expanding numbers of beef cows. For example, more than half the respondents in the Corn Belt and Lake States believed that good prices for feeder cattle during the 1970's are highly probable. Only 10 percent in the two regions gave favorable prices a minimum possibility of occurring. In a later section of this report, a detailed examination is made both of prices that the experts consider necessary to stabilize beef cow inventories and prices needed to cause expansion.

Popularity of Cattle Raising

Likes and dislikes for certain enterprises cannot be measured with precision. They are, however, important in determining the extent to which an enterprise will be pursued.

Beef is usually considered a superior food in this country. The occupation of cattleman serves as a status symbol for many people, farmers and nonfarm investors alike. Considerable romanticism has been attached to cattle raising through the years and there is little evidence that it has abated.

The recent publicity on crossbreeding; exotic breeds, such as Limousin, Charolais, and Simmental; and other phases of cattle raising have attracted

attention. Ownership of beef cattle carries more prestige than involvement with any other major livestock enterprise. These observations add considerable support to the probability that cattle raising will expand even if profits lag.

CHANGES IN PRODUCTION PER COW

The major addition to the supply of beef during the 1970's is expected to come from an expanding number of beef cows, hence a larger number of calves to move into feedlots. Some progress, however, is anticipated in productivity per beef cow.

Factors that increase this productivity or reduce production cost provide an added incentive to the feeder calf producer. Some contribute directly toward a greater supply of beef for eventual consumption. Others merely shift production between cattle feeding and feeder cattle raising. Such shifts add nothing directly to the final supply of beef, but they may increase returns for the cattle raiser and therefore encourage him to expand his operation.

Changes Directly Affecting Beef Supply

The experts in each region were asked to make quantitative estimates of several potential changes in productivity per beef cow that would directly affect the supply of beef obtainable from a given inventory of cows. Factors examined were the reproductive performance of cows, death losses of calves, the disposition of the dairy calf crop, and the weights and ages of beef and dairy breeding stock at time of culling. Possible changes in weights and yields of fed cattle of all types could have a major effect on beef per breeding unit, but this problem was considered to be outside the expertise of panel members.

Calf Crop

Precise measures of the reproductive performance of beef cows have never been reported systematically. Past performance has been estimated by expressing calves born as a percentage of cows and heifers (beef and dairy cows combined) 2 years old and over on January 1. The latest data based on this method of accounting place the national calf crop at 90 percent.

This calving percentage is not a true one. Most persons with an intimate knowledge of beef and dairy operations consider it to be higher than the actual rate. For example, some cows calve at less than 2 years of age; others will prove barren and be culled from the herd although they appear in the January 1 inventory on which the "calving rate" is based.

Nevertheless, these computed rates provide a basis for showing relative differences by State in reproductive performance. Using historical data, the experts were asked to estimate changes expected by 1975 and 1980. Some

questions remain, but we believe the final estimates reflect anticipated change accurately, since interquartile ranges were narrow.

Few experts expect much improvement in the calving percentage in the next 10 years. Estimates for some States remain the same as 1970 figures. In other States, increases of only 1 to 2 percentage points are anticipated. On a weighted basis, the calving percentage nationally might increase from 90 percent in 1970 to 90.4 percent by 1975 and to 91.6 percent by 1980 (table 17).

Expected increases in calving rates were relatively low in the Corn Belt, Lake States, and Northern Plains, where State and regional levels of performance exceeded the national average of 90 percent in 1970. Relatively little change is also expected in the specialized ranching areas because of the extensive nature of production. The largest gains are expected in the Southeast and Southwest, where rates have been the lowest, but the regions should reach only 89 and 91 percent, respectively, by 1980.

In the Southeast, most experts believed that the major source of improvement will be the increased application of such management practices as use of controlled breeding seasons, fertility testing of herd sizes, and pregnancy testing of brood cows. At least partially offsetting the potential gains from these practices are anticipated increases in calving problems because of accelerating shifts to exotic and other large cattle breeds as herd sires. Also, several experts suggested that disease outbreaks, which would tend to slow or reverse increases in calving percentages, may become increasingly frequent as herds grow larger and concentration of brood cows rises. These adverse influences, plus the belief that further gains become more difficult as average calving percentages approach 90 percent, were listed as reasons for anticipating slower improvements in reproductive performance in the 1970's than were realized in the 1960's.

Experts in the Southwest agree that drought and the resulting lack of forage have reduced calving percentages. With improved management leading to better distribution of bulls, hormonal treatments, and improved pastures and ranges, the calving percentages are expected to increase above current levels. Many producers continue to calve out cows at 3 years of age; changing this practice to calving at 2 years would increase calving percentage and herd efficiency. Low fertility of Charolais and Santa Gertrudis cows may reduce calving percentages where more of these breeds are used, some experts say. Others state that nutritional needs of these cattle are different, perhaps higher, and that low fertility may be overcome through better feeding practices. These conclusions apply to other regions as well.

Superovulation (twinning or multiple calving) would obviously have great impact on the calving rate if used successfully to any extent. Opinions were nearly unanimous from all regions, however, that this technology will not be commercially applicable by 1980.

In summary, many techniques are considered important in getting a higher rate of conception and reducing death loss in calving. But producers will adopt few of them substantially by 1980. Furthermore, other changes underway--such as artificial insemination, shifts in the calving period, more confine-

Table 17--Calves born as a percentage of cows and heifers 2 years old and over January 1, by States and regions, 1970 and projected 1975 and 1980 1/

State and region 2/	1970	1975 estimates		1980 estimates	
		Median	Interquartile interval 3/	Median	Interquartile interval 3/
Northeast 4/	86	(86)		(86)	
Ohio	88	90	1	90	3
Indiana	92	91.5	2	93	3
Illinois	89	90	0	91.5	2
Missouri	92	95	2	94	2
Iowa	95	95	2	95	2
Corn Belt	91	92	---	93	---
Minnesota	91	90	1	90.5	2
Wisconsin	90	91	1	92	2
Michigan	89	90	0	90	2
Lake States	90	90.5	---	91	---
North Dakota	95	94.0	1	95.0	1
South Dakota	96	93.3	4	96.3	2
Nebraska	95	92.8	2	93.3	3
Kansas	94	94.4	1	95.9	1
Northern Plains	95	93.6	---	95.1	---
Virginia	89	89	1	90	0
West Virginia	86	90	1	90	1
North Carolina	84	87	1	90	2
South Carolina	87	87	4	89	5
Georgia	87	87	1	89	2
Florida	80	80	0	82	1
Kentucky	90	92	3	94	3
Tennessee	89	89	2	90	4
Alabama	84	86	3	88	2
Mississippi	85	86	1	87	2
Arkansas	87	90	1	90	2
Louisiana	83	85	11	85	8
Southeast	86	87	---	89	---
Arizona	79	84	1	85	4
New Mexico	86	88	6	89	7
Oklahoma	90	91	2	92	4
Texas	88	90	11	91	14
Southwest	88	90	---	91	---
Idaho	94	94	1	95	0
Montana	94	94	1	95	2
Wyoming	90	92.3	4	94	7
Colorado	93	92	10	94	8
Utah	90	92	3	93	2
Nevada 4/	88	(86)	---	(86)	---
Mountain	92	92.6	---	94	---
Washington	92	92	2	93	4
Oregon	92	92	3	94	2
California	88	88	2	90	4
Pacific	90	90	---	92	---
48 States	90	90.4	---	91.6	---

1/ Estimates cover beef and milk cows combined. Percentages are not true calving rates but approximate them.

2/ Regional averages are weighted by numbers in each State in each year.

3/ Interquartile interval is the difference between the values of the first and third quartiles.

4/ No survey made in Northeast or Nevada. Percentages assumed constant at 1970 level in Northeast and slightly lower than 1970 in Nevada.

ment, and larger breeds of cattle--will have a negative effect on the calving rate.

Calf Death Rates

Reductions in calf death rates during 1970-80 are also expected to contribute to increased production per cow. The experts were not asked to estimate how much they expect calf death rates to decline during the 1970's but they did rank this factor along with others that could influence productivity. A majority indicated that reduction in the death rate is expected by 1980.

According to USDA estimates, there is room for improvement. In 1969, calf deaths amounted to 2.6 million head, or 5.8 percent of the total calf crop (table 18). Proportionally, losses have been especially high in some midwestern and southeastern States. Anticipated progress in overall management of cow herds is expected to reduce calf death rates. However, any severe restrictions on use of antibiotics could have a negative effect. Death losses in cattle also have been costly, exceeding 1.5 million head in 1969.

Use of Dairy Calves

In recent years, part of the demand for feeder calves has been satisfied by placing an increasing proportion of the dairy calf crop on feed rather than using the animals as veal or keeping them for replacement. Although numbers of milk cows have declined rapidly and will amount to only about a fifth of all cows by 1980, dairy calves will remain an important potential source of beef. How they are used will affect the production of beef per cow.

Data are not available for current disposition of dairy calves. Therefore, the experts were asked to make estimates for 1970 as well as 1975 and 1980. In this way, expected relative change could be indicated. Estimates were not made in the Northeast, where few cattle are fed, nor in the Western States, where there are not many milk cows.

Heifer calves kept for replacement in the Corn Belt, Lake States, and Southeast, the only regions for which complete estimates are available, reflect the general leveling of milk cow numbers (table 19). Generally, about a third of the total calf crop is and will continue to be held for herd replacement use, and individual States will have small increases or decreases. Need for herd bulls will keep falling as artificial insemination becomes more widely used.

The major shift in these three regions is expected to occur in the percentage of dairy calves used for feeder cattle as opposed to veal. In 1970, an estimated 30 to 50 percent of the dairy calf crop was used for veal (table 20). Overall in the three regions, feeder calves should gain about 10 percentage points of the dairy calf crop at the expense of veal; about two-thirds of the shift will be accomplished by 1975.

Table 18--Death losses from all cattle and calves on farms, by States and regions, 1969

State and region	Calves			All cattle (excluding calves)		
	1969 calf crop	Deaths		1969 on farms on Jan. 1	Deaths	
	Thousands		Percent	Thousands		Percent
Northeast	2,582	200	7.7	4,168	64	1.5
Ohio	737	70	9.5	1,467	36	2.5
Indiana	642	46	7.2	1,330	29	2.2
Illinois	990	75	7.6	2,325	45	1.9
Missouri	2,065	105	5.1	3,353	60	1.8
Iowa	1,897	120	6.3	4,443	105	2.4
Corn Belt	6,331	416	6.6	12,918	275	2.1
Minnesota	1,475	130	8.8	2,762	70	2.5
Wisconsin	2,111	185	8.8	3,260	60	1.8
Michigan	565	57	10.1	1.043	23	2.2
Lake States	4,151	372	9.0	7,065	153	2.2
Virginia	641	47	7.3	1,034	20	1.9
West Virginia	239	15	6.3	360	7	1.9
North Carolina	462	38	8.2	793	20	2.5
South Carolina	279	15	5.4	458	11	2.4
Georgia	819	44	5.4	1,406	31	2.2
Florida	848	28	3.3	1,486	24	1.6
Kentucky	1,293	80	6.2	2,028	37	1.8
Tennessee	1,121	62	5.5	1,725	34	2.0
Alabama	900	39	4.3	1,441	25	1.7
Mississippi	1,248	59	4.7	1,872	44	2.4
Arkansas	869	50	5.8	1,294	28	2.2
Louisiana	923	48	5.2	1,383	40	2.9
Southeast	9,642	525	5.4	15,280	321	2.1
Arizona	350	20	5.7	910	25	2.7
New Mexico	634	35	5.5	1,033	24	2.3
Oklahoma	2,035	95	4.7	3,195	62	1.9
Texas	5,290	195	3.7	8,179	119	1.5
Southwest	8,309	345	4.2	13,317	230	1.7
North Dakota	1,038	62	6.0	1,415	23	1.6
South Dakota	1,805	85	4.7	2,855	57	2.0
Kansas	1,865	90	4.8	3,346	65	1.9
Nebraska	1,951	107	5.5	4,164	78	1.9
Northern Plains	6,659	344	5.2	11,780	223	1.9
Idaho	691	29	4.2	1,135	24	2.1
Montana	1,508	80	5.3	2.097	35	1.7
Wyoming	676	38	5.6	986	25	2.5
Colorado	1,061	49	4.6	2,226	42	1.9
Utah	374	23	6.1	574	15	2.6
Nevada	293	15	5.1	451	12	2.7
Mountain	4,603	234	5.1	7,469	153	2.0
Washington	521	35	6.7	933	24	2.6
Oregon	723	40	5.5	1,110	26	2.3
California	1,588	92	5.8	3,693	68	1.8
Pacific	2,832	167	5.9	5,736	118	2.1
48 States	45,109	2,603	5.8	77,733	1,537	2.0

Source: (8, 14).

Table 19--Median estimates of percentage of dairy calves used as replacement heifers and bulls, Corn Belt, Lake States, and Southeast, 1970, 1975, and 1980 1/

State and region 2/	Replacement heifers			Herd bulls		
	1970	1975	1980	1970	1975	1980
	Percent					
Ohio	33	33	33	2.0	2.0	2.0
Indiana	36	37	35	4.0	2.5	1.5
Illinois	22	21	21	3.0	3.0	2.0
Missouri	37	40	41	0.5	0.5	0.5
Iowa	28	26	25	2.0	1.0	1.0
Corn Belt	31	31	30	2.1	1.7	1.4
Minnesota	31	32	33	1.0	1.0	1.0
Wisconsin	33	36	37	2.0	1.5	1.5
Michigan	42	41	40	2.0	2.0	1.0
Lake States	34	36	36	1.7	1.4	1.3
Virginia	40	41	42	1.0	.5	.5
West Virginia	29	31	33	.5	.5	.5
North Carolina	29	32	33	1.5	1.4	1.0
South Carolina	32	30	30	2.0	1.0	1.0
Georgia	31	30	29	1.0	.5	.5
Florida	30	26	25	1.5	1.0	.5
Kentucky	21	21	22	1.0	.5	.5
Tennessee	27	26	27	4.0	3.0	2.0
Alabama	29	26	25	.5	.5	.5
Mississippi	3/	3/	3/	3/	3/	3/
Arkansas	34	35	35	2.0	1.0	1.0
Louisiana	20	19	18	3.0	2.0	1.0
Southeast	28.3	27.7	28.0	1.8	1.2	.9

1/ Median estimates in each State adjusted proportionately to add to approximately 100 percent for the four categories of calf use: veal calves, feeder calves, heifer replacements, and bull replacements. The percentages do not always add exactly because of decimal fractions shown for herd bulls. Complete estimates were not available for other regions.

2/ Regional estimates weighted by the number of milk cows in or expected to be in each State in the year specified.

3/ Too few responses to permit summarization.

Table 20--Median estimates of the percentage of dairy calves used as veal and feeder calves, Corn Belt, Lake States, and Southeast, 1970, 1975, and 1980 1/

State and region 2/	Veal			Feeder calves		
	1970	1975	1980	1970	1975	1980
	Percent					
Ohio	28	23	23	37	42	42
Indiana	20	11	11	40	50	53
Illinois	22	16	10	53	60	67
Missouri	19	10	5	44	49	53
Iowa	13	15	10	57	58	64
Corn Belt	20	16	12	47	53	56
Minnesota	21	15	14	47	52	52
Wisconsin	31	26	23	34	37	40
Michigan	36	30	25	20	27	34
Lake States	29	23	21	36	40	42
Virginia	28	23	17	29	36	40
West Virginia	66	63	60	4	5	7
North Carolina	50	39	33	20	28	33
South Carolina	35	35	30	31	33	39
Georgia	37	24	23	31	45	47
Florida	39	34	25	29	39	49
Kentucky	51	41	33	27	38	44
Tennessee	50	49	45	19	22	26
Alabama	40	30	25	31	43	49
Mississippi	3/	3/	3/	3/	3/	3/
Arkansas	13	8	6	51	56	58
Louisiana	10	5	3	67	74	78
Southeast	39.6	32.9	28.0	30.3	38.2	43.1

1/ Median estimates in each State adjusted proportionately to add to 100 percent for the four categories of calf use: veal calves, feeder calves, heifer replacements, and bull replacements. Complete estimates were not available for other regions.

2/ Regional estimates weighted by the number of milk cows in or expected to be in each State in the year specified.

3/ Too few responses to permit summarization.

The proportion of dairy calves from the Southeast's dairy herds handled as feeder calves is expected to rise from 30 percent of all dairy calves in 1970 to 38 and 43 percent in 1975 and 1980, respectively. A continuing gain in demand for feeder calves relative to that for veal was mentioned most frequently by the experts as the reason for this anticipated trend. Experts in several States pointed to commercial feedlots in Texas as important current and potential sources of demand for feeder cattle of dairy or dairy-beef breeding. Dairy farmers, in turn, will probably encourage and utilize this demand by continuing their shift to Holstein or other large breeds of milk cows and by using beef-breed semen to inseminate a larger proportion of the cows whose calves will not be considered for herd replacements.

Southwestern experts expect 58 percent of the dairy calves produced in the region will be sold as feeders by 1975, increasing to 64 percent by 1980. Similar gains should occur throughout the region except in Arizona, where the proportion is expected to remain constant at 65 percent. As in other regions, feedlot additions in the Southwest will come largely at the expense of veal. Some dairymen, particularly those in the sorghum grain and wheat areas, are expected to graze and feed out a larger proportion of their calves.

Should the shifts in disposition of dairy calves materialize as projected, dairy cattle will contribute more calves to the feeder cattle supply by 1980. Each calf sent to the feedlot means about 800 pounds more live weight at slaughter.

Weights and Ages of Cull Breeding Stock

Cull cows contribute significantly to the total supply of beef, and currently account for nearly all nonfed beef produced in the United States. From 10 to 20 percent of beef and dairy herds are replaced each year and, barring excessive death losses, something near this range goes to slaughter.

The weight and age at which cows are culled also affect the production of beef per breeding unit. Present cull cow weights and ages have not been measured, so the experts were asked to provide estimates for 1970 as well as for 1975 and 1980.

Cull beef cows in the Corn Belt and Lake States currently weigh around 1,000 pounds (table 21). This weight is 100 to 150 pounds heavier than that of cull beef cows in the Southeast and Southwest. During the 1970's, average weights are expected to increase about 50 pounds in the Corn Belt and Lake States and that much or more in most States in the Southeast. Relatively large gains are expected in Texas and New Mexico; small ones in Arizona and Oklahoma. Similar estimates were not obtained for the other regions.

The heavier weights of cull beef cows in the Corn Belt and Lake States were thought to be due largely to more nutritional and abundant feed. Perhaps the fact that farmers kept their cows in better flesh than necessary also contributed. Reasons for moving toward heavier cows in the 1970's also center around better nutrition. Little evidence was offered by the experts that

Table 21--Median estimates of the weight per head of cull beef and milk cows, Corn Belt, Lake States, Southeast, and Southwest, 1970, 1975, and 1980

State and region 1/	Beef cows			Milk cows		
	1970	1975	1980	1970	1975	1980
	Pounds					
Ohio	1,075	1,088	1,115	1,100	1,175	1,188
Indiana	975	1,000	1,025	1,113	1,150	1,163
Illinois	1,000	1,050	1,075	1,050	1,100	1,100
Missouri	975	1,038	1,075	1,175	1,200	1,250
Iowa	993	1,000	1,100	1,175	1,188	1,200
Corn Belt	991	1,029	1,082	1,128	1,167	1,185
Minnesota	1,050	1,075	1,100	1,175	1,200	1,200
Wisconsin	1,037	1,100	1,100	1,235	1,287	1,300
Michigan	987	1,012	1,050	1,110	1,150	1,150
Lake States	1,038	1,073	1,094	1,200	1,244	1,254
Virginia	925	1,000	1,000	1,200	1,200	1,200
West Virginia	1,000	1,015	1,025	1,100	1,200	1,200
North Carolina	945	975	1,000	1,025	1,100	1,125
South Carolina	900	925	950	1,000	1,000	1,100
Georgia	900	900	975	1,000	1,050	1,100
Florida	850	900	950	900	1,000	1,000
Kentucky	900	950	975	1,000	1,050	1,150
Tennessee	900	915	950	1,010	1,050	1,100
Alabama	850	900	900	1,050	1,050	1,125
Mississippi	850	865	875	NA	NA	NA
Arkansas	875	900	925	1,000	1,035	1,065
Louisiana	900	910	920	900	950	950
Southeast	886	915	940	1,015	1,060	1,102
Arizona	884	884	900	970	1,004	1,069
New Mexico	863	898	958	970	1,004	1,069
Oklahoma	933	944	956	1,336	1,336	1,336
Texas	857	898	924	1,066	1,075	1,075
Southwest	877	909	933	1,121	1,130	1,140

NA = Not available.

1/ Regional estimates weighted by the number of cows in each State in the year specified, except in the Southwest where 1970 numbers were used for each estimate.

producers will select for larger cows, and the larger exotic breeds have yet to appear in significant numbers. To the extent that such breeds are used, however, they will, of course, produce larger cows.

Age of cull beef cows averaged around 7 to 9 years throughout the country. No significant changes are expected in the next 10 years.

Weights of cull milk cows are also higher in the Corn Belt and Lake States than in the Southeast. The average is well over 1,100 pounds, reflecting the more complete conversion to the Holstein breed in the North (table 21). Thus, relatively modest changes in cull weights are expected in the North by 1980.

In the Southeast, according to median estimates, the average weight of cull milk cows is already 1,000 pounds or more in every State except Louisiana and Florida. Further, average weights of cull milk cows should increase faster during 1970-80 than those of beef cows in most other States. The trend among dairy farmers to shift to larger breeds of cows, particularly Holsteins, is expected to continue and was cited by the experts as the major reason for future gains in weights of cull milk cows. Holstein cows are more desirable for beef than the lighter dairy breeds, as indicated by market prices; and Holstein or Holstein crossbred calves are becoming increasingly popular as feeders. Thus, both direct and indirect beef production per milk cow should rise.

Weight data were not available in the Southwest. However, increases in cull weights of milk cows are unlikely by 1975 or 1980. Culling ages will probably remain relatively unchanged in all regions.

Changes Affecting Stage of Production

Size and Character of Enterprise

Generally, cattle raisers have not rigorously applied economic analyses to their operations. Known technologies have been employed sparingly both for increasing production per cow and reducing costs. The typical farmer with a cow-calf enterprise has had little incentive to use such technologies because most of his income has come from other enterprises and his cow enterprise has been largely supplementary.

The experts indicate that a new awareness of technology is likely in the 1970's. Cattle raisers have witnessed the rapid growth in cattle feeding and have heard the phenomenal success stories. They are increasing their herd sizes, becoming conscious of cost and returns, and seeking ways to get a larger share of total industry returns. To some extent, this awareness means cattlemen are putting on more pounds of beef before cattle go to feedlots and reducing the associated costs.

Corn Belt and Lake States

Beef cow enterprises are expected to become substantially larger during the 1970's in the Corn Belt and Lake States (tables 22 and 23). The percentage of farmers having cow herds of fewer than 20 head could drop substantially, but will remain nearly half the total. Farmers with the moderate-sized herds of 20 to 49 cows will increase to a nearly dominant position. Farms with more than 50 cows are expected to comprise about a fourth of the total in 1980, or around 40 percent of all beef cows in the region.

Southeast

Southeastern experts foresee larger beef cow herds during the 1970's, despite the anticipated expansion of beef cow numbers on part-time farms. For the region as a whole, the percentage of farms with fewer than 20 cows will decline to 70 percent of all farms with beef cows by 1975 and to 64 percent by 1980. The share of beef cows in these small herds will drop to 26 percent in 1975 and 22 percent by 1980. As in the past, small herds are expected to include a larger proportion of the beef cows in the Appalachian States, except possibly Virginia, than in the rest of the Southeast. In Florida, by contrast, although more than half the herds in 1980 should continue to contain fewer than 20 cows each, only 4 percent of the State's beef cows will be in small herds.

Experts in each Southeastern State except Louisiana anticipate that herds of 20 to 49 cows each will represent a higher percentage of all herds in 1975 and 1980 than in 1964. Similarly, herds of this size are expected to include larger percentages of total beef cow numbers in 1975 and 1980 in each State except Virginia, Florida, Kentucky, and Louisiana. The increasing importance of this size, according to the experts, will result primarily from continuing expansion of existing small herds. This growth will occur as forage productivity is increased and larger acreages of land per farm suitable primarily for grazing are acquired in conjunction with the expected enlargement of commercial farms in the region.

By 1975, units of 50 or more cows, which are primarily specialized beef farms or beef ranches, are expected to increase to 10 percent of the total and include 46 percent of the beef cows; and by 1980, the experts predict that half of all beef cows in the Southeast will be in herds of 50 or more cows each. Along with the increased importance of large cow herds, a rise is foreseen in forward contract marketing and specification production of feeder cattle in the Southeast.

Southwest

Cow herds in the Southwest are also expected to get larger. Operations of less than 50 head will either drop out or increase in herd size, as will herds of 50 to 99 cows, and 100 cows or more. Arizona will probably lose the largest proportion of small-sized herds by 1980, followed by Oklahoma, Texas, and New Mexico. Stocker cattle herds, important in the Southwest, do not

Table 22--Percentage of farms with beef cows by size of herd, Corn Belt, Lake States, and Southeast, base year and 1975 and 1980 1/

State and region 2/	Herd size (cows) in--								
	Base year 3/			1975			1980		
	Under 20	20 to 49	50 or more	Under 20	20 to 49	50 or more	Under 20	20 to 49	50 or more
	Percent								
Ohio	46	38	16	44	39	17	38	43	19
Indiana	83	15	2	66	24	10	55	28	17
Illinois	72	24	4	59	32	9	51	35	14
Missouri	62	29	9	58	25	17	53	25	22
Iowa	37	46	17	25	47	28	18	44	38
Corn Belt	59	31	10	49	33	18	43	34	23
Minnesota	62	25	13	49	34	17	37	36	27
Wisconsin	60	30	10	64	23	13	51	30	19
Michigan	50	37	13	47	37	16	35	41	24
Lake States	59	29	12	53	32	15	41	35	24
Virginia	77	17	6	45	32	23	39	28	33
West Virginia	86	11	3	75	21	4	68	25	7
North Carolina	89	9	2	83	13	4	75	17	8
South Carolina	85	11	4	75	15	10	67	17	16
Georgia	76	17	7	67	21	12	55	29	16
Florida	64	19	17	57	21	22	54	21	25
Kentucky	79	17	4	70	20	10	65	20	15
Tennessee	82	14	4	78	17	5	78	17	5
Alabama	78	14	8	69	20	11	58	22	20
Mississippi	75	17	8	69	20	11	62	23	15
Arkansas	76	18	6	71	21	8	62	26	12
Louisiana	73	17	10	75	15	10	74	15	11
Southeast	78	16	6	70	20	10	64	22	14

1/ Median estimates adjusted proportionately to add to 100 percent for each year.

2/ Regional estimates weighted by the number of farms reporting beef cows in 1964 in each State.

3/ Base years are 1968 for Corn Belt and Lake States with data from respective State cooperative crop reporting services, and 1964 for the Southeast with data from the 1964 Census of Agriculture.

Table 23--Percentage of beef cows by size of herd, Corn Belt, Lake States, and Southeast, base year, and 1975 and 1980 1/

State and region 2/	Herd size (cows)-- Base year 3/			1975			1980		
	Under 20	20 to 49	50 or more	Under 20	20 to 49	50 or more	Under 20	20 to 49	50 or more
	Percent								
Ohio	23	41	36	16	45	39	12	45	43
Indiana	50	36	14	38	39	23	28	40	32
Illinois	39	40	21	29	42	29	19	43	38
Missouri	37	39	24	30	30	40	26	27	47
Iowa	19	42	39	13	34	53	10	31	59
Corn Belt	38	33	29	24	35	41	19	33	48
Minnesota	38	35	27	30	35	35	19	37	44
Wisconsin	43	36	21	39	35	26	33	36	31
Michigan	33	46	21	24	47	29	17	45	38
Lake States	38	37	25	31	37	32	23	38	39
Virginia	33	32	35	30	30	40	19	27	54
West Virginia	50	31	19	40	40	20	34	43	23
North Carolina	51	27	22	45	30	25	38	31	31
South Carolina	36	26	38	31	28	41	25	27	48
Georgia	30	28	42	20	30	50	15	30	55
Florida	8	9	83	6	7	87	4	5	91
Kentucky	41	35	24	36	35	29	35	35	30
Tennessee	44	32	24	41	34	25	39	35	26
Alabama	26	23	51	20	25	55	15	26	59
Mississippi	27	27	46	24	28	48	20	29	51
Arkansas	33	31	36	25	35	40	20	37	43
Louisiana	20	21	59	15	20	65	12	15	73
Southeast	30	26	44	26	28	46	22	28	50

1/ Median estimates adjusted proportionately to add to 100 percent for each year.

2/ Regional estimates weighted by the number of farms reporting beef cows in 1964 in each State.

3/ Base years are 1968 for Corn Belt and Lake States with data from respective State cooperative crop reporting services, and 1964 for the Southeast with data from the 1964 Census of Agriculture.

occur as small operations as often as do cow-calf operations. Nevertheless, trends in herd sizes similar to those for beef cows are predicted. A large percentage of beef cow and stocker operations will apparently remain small in all four States, but the percentage of all cattle in large units is expected to rise markedly.

Northern Plains and Mountain States

Average size of beef cow herds in the Northern Plains is expected to increase rapidly, with gains between 1970 and 1980 ranging from 25 percent in Kansas to 75 percent in North Dakota. Anticipated changes in the Mountain region are more pronounced; doubling or tripling are expected in some States. Consolidation of farms and ranches, plus the ability to use existing forages more effectively because of larger size, are major reasons for the anticipated growth in average herd size in these regions.

Importance of Size

The significance of the projected changes in size of enterprises is important. A high percentage of all cows will remain in small herds in 1980, which indicates the continuing supplementary character of the cattle enterprise on many cattle-raising farms. Thus, though size of herd will grow substantially, many producers will continue to lack sufficient volume to justify economically the use of many available technologies. Further, the assembling of uniform lots of feeder cattle from a great many small producers for movement to a few large feedlots presents a structural problem for the entire beef industry.

Substantial change in many aspects of the cow-calf business will be necessary for enterprises to grow large enough to move successfully into direct competition with other crop and livestock enterprises. This situation differs from that of any other major agricultural enterprise and will be of major significance in the future growth of cattle raising. In the aggregate, cattle raising is highly important to agriculture and the entire economy, yet cattle are major income producers on only a small percentage of farms where they are raised. Persons who expect radical changes in the near future may be overly optimistic. Nevertheless, the rising number of producers with larger herds can be expected to accelerate adoption of output-increasing changes in management and technology.

Calf Weights

Production of heavier calves is one result of producer attempts to increase efficiency and obtain a larger share of total returns for the beef industry. Heavier calves do not add to total supply of beef unless they result from breeds which reach slaughter condition at heavier weights. Generally, they simply reduce the gain to be made at the feedlot. In this respect, however, production of heavier calves may enhance feedlot operations, especially the larger ones. They commonly feed high-concentrate rations and

prefer to get feeder cattle weighing 600 to 700 pounds. When calves are sold at around 400 pounds, there is incentive for intermediate-phase operations, including specialized growing of calves to the weights preferred by feedlots.

The panel members were asked to estimate the 205-day weights of steer calves for 1970, 1975, and 1980. The results show about a 50-pound gain by 1980 in the eastern half of the country (table 24). A slightly smaller increase is expected for the Southwest, where estimates reflect sales weights rather than specific 205-day weights, but the differentials show gains to cow-calf producers regardless of the base.

Increased calf weights are expected to result from a combination of factors, including improved selection of breeding stock, crossbreeding among several breeds of both beef and dairy cattle, and improved nutrition of both cows and calves. Artificial insemination, estrus control, and change in age of weaning calves will probably be used by only a small percentage of producers.

In the Southeast, average weight of beef breed steer calves at 205 days will increase from 382 pounds in 1970 to 448 pounds by 1980. This anticipated gain of 66 pounds per calf during the 1970's is about 2.5 times the predicted rise of 26 pounds in the area as a whole during the 1960's. Two related factors seem to explain the relatively small gains during the 1960's: the former popularity of short, blocky cattle that tended to produce less milk and the rapid increase of beef cow numbers. These two occurrences necessitated retaining a relatively high percentage of available heifer calves for replacement and expansion of breeding stock, regardless of growth rate and milk production potential. Between 1970 and 1980, by contrast, brood cow numbers should go up less rapidly. Greater use of production records to select breeding stock with superior growth rate potential is expected.

Other anticipated developments will also contribute to the faster increase in average calf weights during the 1970's, including improvements in nutrition levels of both brood cows and nursing calves, primarily as a result of better forage production and management practices. Acceleration is expected in the use of systematic crossbreeding programs, many of which will involve exotic or large dairy breeds besides British beef breeds and, particularly in the Gulf Coast States, Brahman cattle.

Experts in the Southeast view crossbreeding with more optimism than experts in most other regions, where British breeds have long been dominant. In the Corn Belt and Lake States, British-exotic breed crosses will help increase calf weights, but many of the experts question the feedlot quality of resulting calves and also the quality of dairy-beef crosses. A demand for leaner beef could alter this view as both British-exotic and dairy-beef crosses produce a leaner animal. Problems in reproduction and difficulties with calving are recognized.

The expected level of adoption of crossbreeding varies considerably, but British-exotic crosses will probably be used by fewer than 25 percent of the farmers in 1980. British-dairy crosses will be used by about half the producers in the Lake States and by many in the Southeast, but by relatively few

Table 24--Median estimates of weight of steer calves of beef breeds at 205 days, Corn Belt, Lake States, Southeast, and Southwest, 1970, 1975, and 1980 1/

State and region	1970	1975	1980
		Pounds	
Ohio	420	442	467
Indiana	415	432	472
Illinois	435	452	478
Missouri	400	415	430
Iowa	400	445	472
Corn Belt	408	432	452
Minnesota	405	425	450
Wisconsin	425	435	455
Michigan	418	420	430
Lake States	412	427	449
Virginia	450	490	500
West Virginia	437	440	450
North Carolina	402	425	455
South Carolina	380	425	490
Georgia	400	437	462
Florida	350	395	460
Kentucky	355	390	450
Tennessee	425	450	475
Alabama	380	425	475
Mississippi	343	375	400
Arkansas	400	432	450
Louisiana	360	375	385
Southeast	382	414	448
Arizona	403	403	421
New Mexico	411	448	520
Oklahoma	440	462	474
Texas	425	445	465
Southwest 2/	427	448	470

1/ Regional estimates weighted by number of calves produced in each State in the year specified.

2/ Weights in the Southwest were estimated for beef calves at time of sale off range or pasture and are not necessarily weights at 205 days.

in other regions. Developments in crossbreeding are expected to occur more among the existing British beef breeds, and to act as a catalyst to development within these breeds; that is, they will select animals for breeding purposes based on desirable carcass characteristics and meat production potential. Certainly, crossbreeding warrants careful study and consideration.

In the Southwest, experts differed considerably in predictions of the amount of change in weights of calves sold. Many believed that increased demands for feeder cattle will stimulate production of more calves averaging lighter in weight and resulting in a faster turnover. Yet the estimates show a rise in average weights. Thus, to a degree, the idea of slaughtering heavier cattle seems to be built into some of the data.

Feeder calves in the Southwest are expected to become slightly heavier, from 427 pounds per head in 1970 to 470 pounds by 1980, at 7 to 8 months of age. The largest growth in feeder calf weight should occur in New Mexico, where average age at sale will go from 8 months to 9 months. The least change and lightest weight are expected in Arizona, where by 1980 the average at 7 months of age is expected to be only 421 pounds.

Experts predict no change in age of feeder calves sold off ranges and pastures in Oklahoma, but an increase of 34 pounds per head in weight. The expected rise in average weight per head over 1970 estimated levels in Texas amounts to from 25 to 50 pounds in most areas of the State.

Yearling Weights

Farmers and ranchers can produce more of the total beef supply by growing calves beyond weaning weights. This practice is followed to some extent in all regions and varies by years, depending on available resources. The experts think the trend is toward production of heavier calves from cow-calf operations in all regions, but in the Southwest, yearling cattle remain especially important. Therefore, estimates of weight changes were made for both short and long yearlings in this region.

Short yearlings are calves held over because they are considered too light to sell as calves or because adequate forage is available. Usually, they are sold at just under 1 year of age, although they may be held longer for sale as full-fledged yearlings. Such animals provide a degree of flexibility, allowing operators to adjust easily to changes in forage supplies.

According to expert opinion, the average age of short yearlings in the four Southwestern States now ranging from 11 months in Texas to 14 months in Arizona and New Mexico is expected to change little by 1980. The average weight per head at time of sale was estimated at 588 pounds in 1970, rising to 604 pounds per head in 1975 and 643 pounds by 1980. The oldest and heaviest animals would be in New Mexico, followed by Oklahoma, Texas, and Arizona. As they have the greatest feed potential, the heavy wheat and sorghum grain-producing areas within the region are expected to increase weights of yearling cattle the most.

Long-yearling calves also offer opportunity for flexibility. The main difference between the two classes of cattle is that the long yearling is slightly older. In the Southwest, the average estimated age of long yearlings is 16 months. The average weight per head should rise from 690 pounds in 1970 to 719 pounds in 1975 and 734 pounds in 1980. New Mexico will keep these yearlings to an older age and to the heaviest weights. The lightest yearlings probably will come from Arizona. Evidence supporting changes in selling ages and weights of yearlings in Oklahoma is spotty, although gains in average weight without commensurate increases in age seem likely. In Texas, rather large increases in yearlings' selling weight are expected in several districts without much change in selling age.

ESTIMATED PRICES FOR STEADY AND EXPANDING COW NUMBERS

The price of feeder cattle relative to the prices of other farm products and resources will be a major determinant of the level of cattle raising in all regions. The experts were asked to make estimates against a given set of price relationships (table 14). They were asked two final questions: "You have made all previous estimates under a given set of price relationships. Assume that all of these prices hold except for beef cattle. What is the price for 450 to 500 pound choice steer calves needed to hold the inventory of beef cows relatively stable in your State? What is the minimum price for such calves needed to give strong encouragement to expansion of the number of beef cows in your State?"

The resulting price estimates hovered around $30 for stable conditions and around $35 for expansion (table 25). Thus, price expectations, the price considered necessary for expansion, and the price that formed the base for projecting beef cow numbers were compatible.

Those regions that seem to be closest to their physical productive capacity without substantial addition of feed production technologies reflect the higher prices under each situation. Relatively lower prices are believed necessary in regions where productive capacity can be increased with relatively small changes. The Southwest typified the former; the Corn Belt and Southeast, the latter. However, part of the difference in price estimates between regions no doubt reflects historical conditions relative to both prices and quality of calves.

ESTIMATED BEEF PRODUCTION, 1980

Future supplies of beef will be influenced by a great many factors. Some will affect the number of cows kept by farmers and ranchers. Others will help determine production per beef cow either as a direct contribution to the supply of beef or as a change in the proportion of beef produced in cow-calf operations compared with that produced in feedlots.

Research aimed at estimating future supplies of beef should consider factors which will be most important in determining changes in supply. It is not possible to include all factors in an intensive analysis. Questions

Table 25--Prices needed per 100 pounds of 450-550 pound choice steer calves to maintain stable beef cow numbers and to encourage future expansion, Corn Belt, Lake States, Southeast, Northern Plains, and Southwest

State and region 1/	Stable numbers		Expansion	
	Median	Interquartile interval	Median	Interquartile interval
	Dollars			
Ohio	32.50	1.00	34.50	3.00
Indiana	32.00	1.00	34.00	5.00
Illinois	29.50	1.00	34.50	3.00
Missouri	30.00	2/	33.50	2/
Iowa	30.00	1.00	32.50	5.00
Corn Belt	30.29	---	33.48	---
Minnesota	31.00	6.00	35.00	1.00
Wisconsin	30.00	5.00	33.00	2.00
Michigan	34.50	4.00	38.50	5.00
Lake States	31.21	---	34.95	---
Virginia	30.00	2.00	35.00	4.00
West Virginia	30.00	8.00	33.00	5.00
North Carolina	27.00	4.00	32.00	3.00
South Carolina	30.00	2.00	33.00	3.00
Georgia	31.00	6.00	34.00	4.00
Florida	28.00	5.00	31.00	2.00
Kentucky	30.00	4.00	34.00	3.00
Tennessee	31.00	4.00	34.00	2.00
Alabama	30.00	4.00	35.00	2.00
Mississippi	30.00	2.00	33.00	2.00
Arkansas	30.00	6.00	35.00	8.00
Louisiana	30.00	9.00	34.00	8.00
Southeast	29.87	4.62	33.69	3.75
North Dakota	28.75	10.00	34.88	8.50
South Dakota	33.50	6.00	38.33	5.00
Nebraska	30.50	1.00	37.50	2.00
Kansas	31.12	5.00	36.00	5.00
Northern Plains	31.22	---	36.90	---
Arizona 3/	34.00	15.00	45.00	5.00
New Mexico	34.00	5.00	36.00	10.00
Oklahoma	32.00	5.00	35.00	5.00
Texas	35.00	6.00	38.00	5.00
Southwest	34.15	---	37.41	---

1/ Regional values weighted by January 1, 1970 numbers of beef cows in each State.
2/ Too few estimates.
3/ Responses were limited; thus, the interval shown represents the complete range.

addressed to the panel of experts were therefore designed to rank in importance the potential supply shifters. One series of questions elicited opinions about the relative importance and likelihood of acceptance or occurrence of technologies, practices, and situations affecting the number of beef cows that will be kept. Another line of questions aimed at estimating the relative importance and likelihood of acceptance or occurrence of technologies and practices affecting beef produced per cow. Results have been used throughout this report, but for conciseness, the opinions are summarized in tables 26 and 27.

These data provide a useful guideline for supply-response research. Factors the experts considered both important and highly likely to occur should receive first priority in an analysis. Factors thought to be either of little importance in affecting supply of beef or unlikely to occur regardless of importance could presumably be omitted with limited effect on the accuracy of supply estimates. Whenever expert opinion is divided, researchers are duly cautioned to make a thorough examination before either including or excluding the particular factor from a study of supply response.

The survey yielded projections of a 46,276,000 head beef cow herd and a 12,115,000 head dairy herd in 1980. Computations estimating the quantity of beef that could be produced by these cows with accompanying assumptions are presented below. Following them, estimates of imports and exports complete the picture of the total supply of beef expected to be available for consumption in 1980.

Base Quantity

By 1980, essentially all beef calves not used for herd replacement or expansion will be fed to slaughter weight. The total calf crop minus calf deaths, calves saved for cow and bull replacements, and calves kept for herd expansion is destined for feedlots. Beef production from feedlots amounts to the number placed on feed, minus feedlot deaths, multiplied by fed-carcass weight. Meat supplied by culling mature animals from the beef herd amounts to the product of culling rate, cull-carcass weight, and beef herd size. These relationships are specified for computation in the following equation.

$$(1)\quad BHPN = FCR\ (1 - FCDL)\ \Big[(1 - BCDL)\ (BHCC)\ BHRD - (1 + RDL)\ (BCRP + BBRP + BHXP)\ BHRD\Big] + BHCL\ (CLCR)\ BHRD$$

Variables BHPN, FCR, and so on are defined in table 28. Substituting assumed values from table 28 into equation (1) yields 22,956 million pounds of beef supplied by the projected 1980 beef herd.

Although a smaller proportion than beef cattle, dairy calves fed to slaughter weight and cull milk cows also contribute to total beef supply. Dairy calves going into feedlots are equal to the dairy calf crop minus calf deaths, calves saved for cow and bull replacements, and calves slaughtered for veal. As in the beef herd computation, feedlot beef production from dairy calves amounts to the number placed on feed minus feedlot deaths, multiplied

Table 26--Estimated relative importance (I) and likelihood of acceptance or occurrence (A) of technologies, practices, and situations affecting numbers of beef cows, by regions, 1980 1/

Technology, practice, or situation	Corn Belt		Lake States		Southeast		Southwest		Northern Plains		Mountain-Pacific	
	I	A	I	A	I	A	I	A	I	A	I	A
Favorable prices	1	1	1	1	1	1	1	1				
Fertilizing of--												
Pastures	2	1	2-3	1	1	1	1-2	2	1	1	1	
Ranges									1	3	2-3	
Haylands									1	1		
Irrigation	3	3	3	3	3	3	2	2	2-3	2-3	1-2	
Drought							1	2				
Increase in--												
Hay quality	3	1-3	2	1-2	1-2	1-2	2	2				
Tame pastures							1-2	2				
Temporary pastures							2-3	2				
Cropland pastures							1-2	2				
Rangeland							2-3	3				
Brush control							1-2	2	1-2	1	1-2	
Range seeding							1-2	2	1-2	2	1-3	
Quality of plants	2	1-2	2	1-2	1	1	2	2				
Restriction in use of--												
Herbicides	3	3	3	1-3	3	1-3	1-2	2				
Insecticides	3	3	3	1-3	3	1-3	1-2	2				
Deferred and rotation grazing							1-2	2				
Proper stocking							1-2	2				
Grazing associations									2-3	3		
More of--												
Grass-legume silage	2-3	1-3	2	1-2	1-2	1	2	2	2-3	2	2-3	
Corn silage	2-3	1-3	2-3	1-2	1-2	3			2-3	2	2-3	
Husklage	3	1-2	1-2	1-2	2-3	1-3						
Increased feeding						2	2	2				
Mechanized feeding	2-3	1-2	1-3	1	2-3	1	2-3	2	2	1	2	

See footnotes at end of table.

Continued

Table 26--Estimated relative importance (I) and likelihood of acceptance or occurrence (A) of technologies, practices, and situations affecting numbers of beef cows, by regions, 1980 1/--Continued

Technology, practice, or situation	Corn Belt		Lake States		Southeast		Southwest		Northern Plains		Mountain-Pacific	
	I	A	I	A	I	A	I	A	I	A	I	A
Semiconfinement	1-3	2	3	2-3	3	3	1-3	2	2	3	2-3	
Total confinement	3	3	3	3	3	3	1-3	3	3	3	3	
Livestock changes--												
Add cow enterprise	2	2-3	1-2	2			2-3	2				
Drop cow enterprise	1-3	2-3	2-3	3			1-2	2-3				
Add stocker enterprise							1-2	2				
Drop stocker enterprise							2	2				
Dairy to beef cows	2	3	1-2	2-3	3	2-3	2-3	2	2	1-3	2-3	
Sheep-goats to beef cows							1-3	1				
Yearlings to calves									1	1-3	1-2	
Larger farms	2	1-2	2	1	1-2	1						
More part-time farms	3	3	1-3	3	1-3	3						
Larger cow herds	1-2	1	2	1			2	1-2				
Specialization in beef					1-3	1						
More land for recreation						2	2	2				

1/ Estimates reflect the situation expected to prevail for herds of 50 or more cows in the Corn Belt, Lake States, and Southeast. They apply to all herds in the other regions.

Note: I = importance; A = acceptance or occurrence. In the I columns, number 1 means great importance; 2, average importance; 3, little or no importance. Single valued positions are those chosen by 50 percent or more of the respondents. A range means divided opinion at the levels indicated and includes every position that received 25-49 percent of the estimate. In the A columns, number 1 means acceptance or occurrence is highly likely; 2, average possibility; 3, minimal possibility. A range means divided opinion at the levels indicated.

Blanks indicate data were not applicable.

Table 27--Estimated relative importance (I) and likelihood of acceptance or occurrence (A) of technologies and practices affecting beef produced per beef cow, by regions, 1980 1/

Technology or practice	Corn Belt		Lake States		Southeast		Southwest		Northern Plains		Mountain-Pacific	
	I	A	I	A	I	A	I	A	I	A	I	A
British crosses	1-2	3-4	1-3	3-4	2	2-4	1-2	3		1-2	1-2	
British exotic crosses	1-3	3-4	1-3	4	1-2	3-4	1-2	4	1-2	2	1-2	
British-dairy crosses	1-3	4	1-2	3	1-3	4	1-2	3-4				
Performance testing	1	3-4	1	2-3	1	3-4	1-2	3-4	1	2	1-2	
Artificial insemination	2	3-4	1-2	3-4	1-2	4		4	2-3	1-3	2-3	
Confinement	3	4	2	4	3	4	1-2	3-4	3	3-4		
Cow nutrition	2	2-3	2	2-3	1	2-3	1-2	2-3	1	1-2	1-2	
Life of cows	2	1-3	2	1-3	1-3	2-4	1-2	2-4	1-2	2-3	1-2	
Calving percentage	1	1-2	1	1-3	1	1-2	1-2	2-3				
Multiple calving	2-3	4	2-3	4	3	4			3	4	2-3	
Calving dates	2	3-4	2-3	4	1-2	2-4	2	3-4				
Weaning age	3	4	2-3	3-4	2-3	3-4	2-3	4	3	3-4		
Calf nutrition	1-3	2-4	1	2-3	1	2-3	2-3	3-4				
Age when first calf born	1-3	2-4	1-3	3-4		2	4					
Calf grow out					1	2-3						
Calf deaths	1	1-2	1	2-4	1	2-4	1-2	2-4	1-2	1-2	1-2	
Restriction of antibiotics					1-3	4	1-3	2				
Cow selection	1	1-3	1-2	1-2			1-2	2-4				
Bull selection	1	1-3	1-2	1-2			2	2-3				
Herd size	2-3	1-2	2	2			1	2-3				
Closer management							1-2	2-4				
Improvement of pastures--												
Tame							1-3	3-4				
Temporary							1-3	3-4				
Native							1-2	3-4				
Controlled sex									3	4		

1/ Estimates reflect the situation expected to prevail for herds of 50 or more cows in the Corn Belt, Lake States, and Southeast. They apply to all herds in the other regions.

Note: I = importance. In I columns, number 1 means great importance; 2, average importance; 3, little or no importance. Rating may also be low if the factor is thought to have negative effect on productivity. A range means divided opinions at the levels indicated. A = acceptance. In A columns, number 1 means over 75 percent; 2 means 51-75 percent; 3 means 26-50 percent; 4 means 25 percent or less. A range means divided opinions at the levels indicated.

Blanks indicate data were not applicable.

Table 28--Variables and assumptions for estimating 1980 beef supply

Item	Abbreviation	Value 1/
a. Population	PPLN	230 million
b. Per capita beef consumption	PCBC	128.5 pounds
c. Fed cattle from live imports	FCLI	700,000 head
d. Beef imports	BIMP	1,500 million pounds
e. Beef exports	BEXP	150 million pounds
f. Dairy herd stabilized at	DHRD	12,115,000 head
g. Beef herd increased to	BHRD	46,276,000 head
h. Fed carcass	FCR	630 pounds
i. Cull carcass, cull-bull-stag	CLCR	518 pounds
j. Fed-cattle death loss	FCDL	1 percent
k. Replacement death loss	RDL	1 percent
Beef herd:		
l. Calf crop	BHCC	91 percent
m. Calf death loss	BCDL	5 percent
n. Calves retained for cow replacement	BCRP	17 percent
o. Calves retained for bull replacement	BBRP	1 percent
p. Calves retained for herd expansion	BHXP	2 percent
q. Herd cull (cows + bulls - 2-percent death loss)	BHCL	16 percent
Dairy herd:		
r. Calf crop	DHCC	94 percent
s. Calf death loss	DCDL	6 percent
t. Calves retained for cow replacement	DCRP	25 percent
u. Calves retained for bull replacement	DBRP	0.5 percent
v. Vealers (345 million pounds ÷ 115-pound carcass)	VLR	3 million head
w. Herd cull (cows + bulls - 1-percent death loss)	DHCL	24.5 percent
Beef supply:		
x. Beef herd production	BHPN	22,956 million pounds
y. Dairy herd production	DHPN	4,397 million pounds
z. Total beef supply	TBS	29,144 million pounds

1/ Factors underlying assumptions a through w are listed in Appendix. Values x, y, and z are calculated in the equations listed previously.

by the fed-carcass weight. Cull milk cows contribute to beef supply by an amount equal to the product of dairy herd culling rate, cull-carcass weight, and size of the milk cow herd. These relationships are specified in the following equation.

$$(2)\ DHPN = FCR\ (1 - FCDL)\ \left[(1 - DCDL)\ (DHCC)\ DHRD - (1 + RDL)\ (DCRP + DBRP)\ DHRD - VLR\right] + DHCL\ (CLCR)\ DHRD$$

Substituting values from table 28 into equation (2) yields 4,397 million pounds of beef supplied by the projected 1980 dairy herd.

The total beef supply projected for 1980 is equal to the sum of beef herd production (BHPN) plus dairy herd production (DHPN) adjusted for fed-carcass weight of feeder cattle imports, slaughtered beef imports, and beef exports. In equation form:

$$(3)\ TBS = BHPN + DHPN + FCLI\ (FCR) + BIMP - BEXP$$

Substitution of values from equations (1) and (2) and table 28 into equation (3) yields a total beef supply (TBS) in 1980 of 29,144 million pounds. Total beef available divided by the population level given in table 28 amounts to a per capita consumption of 126.7 pounds.

Sensitivity of Estimate

The beef production estimate generated by these equations is sensitive to the assumptions incorporated. Changing the levels of some of the assumed percentages increases or decreases the total estimate of beef to be produced. To illustrate the importance of the assumed levels to the total production figure, table 29 shows the effects of varying carcass weights plus or minus 10 pounds. Also shown are the combined effects of raising (lowering) the beef calving rate half a percent and lowering (raising) the beef calf death loss half a percent. Finally, the production changes associated with all three factors (carcass weight, beef calf deaths, and beef calving rate) varying in concert are shown.

Changes in the population estimate will also affect the estimated per capita beef supply. Variations in per capita beef supply resulting from Bureau of Census schedules C (232,412,000) and D (227,510,000) are used for illustration. The result is a range over which the per capita beef supply estimate can vary. For example, the beef supply estimate (productivity level A) ranges from 125.4 pounds to 128.1 pounds per person as the population estimate is reduced from 232,412,000 to 227,510,000 (table 29).

The combined effects of varying productivity assumptions and population estimates on per capita beef supplies are indicated by the bottom two rows of table 29. These minimum and maximum quantities identify a range in per capita beef supply from 122.8 to 130.8 pounds.

Table 29--Beef production and per capita beef supply under several productivity levels with assumptions, 1980

Productivity level (A-G)	Carcass weight	Beef calf deaths	Beef calving rate	Total beef available 1/	Per capita beef supply 2/ Population 3/ 232,412	230,000	227,510
	Pounds	Percent	Percent	Billion pounds 4/	Pounds	Pounds	Pounds
Base production:							
A	630	5.0	91.0	29.144 (100.0)	125.4	126.7	128.1
Variations in carcass weight:							
B	640	5.0	91.0	29.493 (101.2)	126.9	128.2	129.6
C	620	5.0	91.0	28.795 (98.8)	123.9	125.2	126.6
Variations in death loss and calving rate:							
D	630	4.5	91.5	29.413 (100.9)	126.6	127.9	129.3
E	630	5.5	90.5	28.876 (99.1)	124.2	125.5	126.9
Variations in carcass weight, death loss, and calving rate:							
F	640	4.5	91.5	29.766 (102.1)	128.1	129.4	130.8
G	620	5.5	90.5	28.532 (97.9)	122.8	124.1	125.4

1/ Includes 1.79 billion pounds of imported beef.
2/ Computed by dividing total beef available by population.
3/ Population in thousands.
4/ Numbers in parentheses are percentages of base productivity level.

Table 30--Regional shifts in acreages of cropland, pasture and range land, and forest land, 1958-67

Region	Cropland			Pasture and range			Forest		
	1958	1967	Change	1958	1967	Change	1958	1967	Change
	---1,000 acres---		Percent	---1,000 acres---		Percent	---1,000 acres---		Percent
Northeast	20,907	19,293	- 7.7	7,991	5,527	-30.8	65,913	69,226	+5.0
Corn Belt and Lake States	139,614	140,658	+ 0.7	30,745	28,057	- 8.7	74,552	76,882	+3.1
Southeast	68,465	65,573	- 4.2	38,918	38,417	- 1.3	182,965	187,684	+2.6
Northern Plains	93,896	95,759	+ 2.0	83,902	79,959	- 4.7	3,672	3,653	-0.5
Southwest	60,459	52,737	-12.8	174,094	181,550	+ 4.3	51,045	50,314	-1.4
Mountain	38,282	38,560	+ .7	117,935	117,190	- 0.6	24,848	24,917	+ .3
Pacific	25,776	24,622	- 4.5	31,130	30,289	- 2.7	46,647	46,261	- .8

Source: (3, 4).

Table 31--Beef cows and heifers 2 years old and over: Interquartile ranges and medians of estimates and percentage deviation from medians, Corn Belt, Lake States, Southeast, and Northern Plains, 1975 and 1980

State and region	1975				1980			
	Median	Interquartile range	Deviation from median		Median	Interquartile range	Deviation from median	
			Below	Above			Below	Above
	Thousands		Percent		Thousands		Percent	
Ohio	400	400-432	0.0	8.0	450	450-450	0.0	0.0
Indiana	490	475-500	3.1	2.0	550	530-550	3.7	.0
Illinois	819	786-850	4.0	3.8	912	800-950	12.3	4.1
Missouri	2,400	2,300-2,400	4.2	0.0	2,600	2,600-2,600	.0	.0
Iowa	1,800	1,643-1,850	8.7	2.8	2,200	1,800-2,300	18.2	4.5
Corn Belt	5,909	5,604-6,032	5.2	2.1	6,712	6,180-6,850	8.0	2.0
Minnesota	665	650-700	2.3	5.3	815	775-850	5.0	4.2
Wisconsin	290	285-340	1.7	17.2	362	350-400	3.4	10.4
Michigan	147	133-150	9.5	2.0	170	143-200	15.9	17.6
Lake States	1,102	1,068-1,190	3.1	8.0	1,347	1,268-1,450	5.9	7.6
Virginia	550	525-565	4.5	2.7	587	550-600	6.4	2.2
West Virginia	220	210-230	4.5	4.5	242	215-250	11.2	3.3
North Carolina	425	410-446	3.5	4.9	500	467-525	6.6	5.0
South Carolina	300	288-306	4.0	2.0	340	325-350	4.5	2.9
Georgia	900	850-990	5.6	10.0	980	900-1,100	8.2	12.2
Florida	977	977-1,000	.0	2.4	1,053	1,053-1,058	.0	.4
Kentucky	1,310	1,300-1,400	.8	6.9	1,637	1,400-1,850	14.5	13.0
Tennessee	1,092	1,050-1,200	3.8	9.9	1,250	1,150-1,336	8.0	6.8
Alabama	1,029	1,000-1,070	2.8	4.0	1,200	1,100-1,200	8.4	.0
Mississippi	1,464	1,425-1,464	2.7	.0	1,684	1,600-1,684	5.0	.0
Arkansas	1,085	1,050-1,100	3.2	1.4	1,195	1,174-1,249	1.8	4.5
Louisiana	990	963-1,030	2.7	4.0	1,150	1,010-1,375	12.2	19.5
Southeast	10,342	10,048-10,801	2.8	4.4	11,818	10,944-12,577	7.4	6.4
North Dakota	1,137	1,084-1,300	4.7	14.3	1,323	1,214-1,350	8.2	2.0
South Dakota	1,940	1,920-1,950	1.0	.5	2,180	2,130-2,250	2.3	3.2
Nebraska	2,204	2,077-2,400	5.8	8.9	2,623	2,190-3,400	16.5	29.6
Kansas	2,140	2,023-2,250	5.5	5.1	2,387	2,100-2,600	12.0	8.9
Northern Plains	7,421	7,104-7,900	4.3	6.5	8,513	7,634-9,600	10.3	12.8
Total	24,774	23,824-25,923	3.8	4.6	28,390	26,026-30,477	8.3	7.4

Table 32--Milk cows and heifers 2 years old and over: Interquartile ranges and medians of estimates and percentage deviation, Corn Belt, Lake States, Southeast, and Northern Plains, 1975 and 1980

State and region	1975				1980			
	Median	Interquartile range	Deviation from median		Median	Interquartile range	Deviation from median	
			Below	Above			Below	Above
	Thousands		Percent		Thousands		Percent	
Ohio	450	450-475	0.0	5.6	450	425-480	5.6	6.7
Indiana	250	240-250	4.0	0.0	225	200-237	11.1	5.3
Illinois	322	300-330	6.8	2.5	300	275-300	8.3	0.0
Missouri	350	350-375	.0	7.1	325	325-375	0.0	15.4
Iowa	500	460-500	8.0	.0	500	400-500	20.0	.0
Corn Belt	1,872	1,800-1,930	3.8	3.1	1,800	1,625-1,892	9.7	5.1
Minnesota	952	900-1,000	5.5	5.0	900	800-980	11.1	8.9
Wisconsin	2,000	2,000-2,050	.0	2.5	2,000	1,900-2,200	5.0	10.0
Michigan	455	450-475	1.1	4.4	420	400-450	4.8	7.1
Lake States	3,407	3,350-3,525	1.7	3.5	3,320	3,100-3,630	6.6	9.3
Virginia	217	195-250	10.1	15.2	193	160-240	17.1	24.4
West Virginia	65	60-67	7.7	3.1	60	53-65	11.7	8.3
North Carolina	185	180-200	2.7	8.1	182	165-190	9.3	4.4
South Carolina	70	62-74	11.4	5.7	65	50-72	23.1	10.8
Georgia	150	140-155	6.7	3.3	149	135-155	9.4	4.0
Florida	196	186-205	5.1	4.6	197	185-210	6.1	6.6
Kentucky	367	345-395	6.0	7.6	352	320-425	9.1	20.7
Tennessee	305	295-345	3.3	13.1	295	280-355	5.1	20.3
Alabama	142	140-150	1.4	5.6	147	138-150	6.1	2.0
Mississippi	200	200-213	.0	6.5	195	175-202	10.3	3.6
Arkansas	100	90-100	10.0	.0	90	80-100	11.1	11.1
Louisiana	176	164-192	6.8	9.1	160	149-192	6.9	20.0
Southeast	2,173	2,057-2,346	5.3	8.0	2,085	1,890-2,356	9.4	13.0
North Dakota	161	145-200	10.1	24.2	176	125-250	29.0	42.0
South Dakota	160	140-170	12.5	6.2	143	130-150	9.1	4.9
Nebraska	188	175-200	6.9	6.4	175	150-200	14.3	14.3
Kansas	205	200-220	2.4	7.3	175	160-180	8.6	2.9
Northern Plains	714	660-790	8.6	10.6	669	565-780	15.6	16.7
Total	8,166	7,867-8,591	3.7	5.2	7,874	7,180-8,658	8.8	10.0

Table 33--Beef cows by size of herd and regions, 1969

Region	Size of herd (cows)				
	1 to 19	20 to 49	50 to 99	100 and over	Total
			Number		
Northeast	89,396	96,735	44,148	36,111	266,390
Corn Belt and Lake States	1,172,147	2,249,136	1,216,989	752,942	5,391,214
Southeast	838,325	1,782,770	1,321,500	2,419,305	6,361,900
Northern Plains	439,747	1,476,247	1,584,534	2,518,985	6,019,513
Southwest	396,775	1,455,180	1,483,560	3,888,222	7,223,737
Mountain	97,005	382,230	637,563	2,973,763	4,090,561
Pacific	78,033	192,129	228,909	1,170,003	1,669,074
48 States	3,111,428	7,634,427	6,517,203	13,759,331	31,022,389
			Percent		
Northeast	33.6	36.3	16.6	13.5	100.0
Corn Belt and Lake States	21.7	41.7	22.6	14.0	100.0
Southeast	13.2	28.0	20.8	38.0	100.0
Northern Plains	7.3	24.5	26.3	41.9	100.0
Southwest	5.5	20.1	20.5	53.9	100.0
Mountain	2.4	9.3	15.6	72.7	100.0
Pacific	4.7	11.5	13.7	70.1	100.0
48 States	10.0	24.6	21.0	44.4	100.0

Source: (13). Data based on only Class I through V commercial farms.

Table 34--Farms with beef cows by size of herd and regions, 1969

Region	Size of herd (cows)				
	1 to 19	20 to 49	50 to 99	100 and over	Total
			Number		
Northeast	12,476	3,316	683	202	16,677
Corn Belt and Lake States	126,623	75,552	18,703	4,938	225,816
Southeast	92,648	58,846	20,063	10,654	182,211
Northern Plains	41,995	46,895	23,358	13,208	125,456
Southwest	38,360	46,228	21,993	15,454	122,035
Mountain	10,775	11,765	9,111	11,576	43,227
Pacific	10,135	6,146	3,324	4,049	23,654
48 States	333,012	248,748	97,235	60,081	739,076
			Percent		
Northeast	74.8	19.9	4.1	1.2	100.0
Corn Belt and Lake States	56.1	33.5	8.3	2.1	100.0
Southeast	50.8	32.3	11.1	5.8	100.0
Northern Plains	33.5	37.4	18.6	10.5	100.0
Southwest	31.4	37.9	18.0	12.7	100.0
Mountain	24.9	27.2	21.1	26.8	100.0
Pacific	42.8	26.0	14.1	17.1	100.0
48 States	45.1	33.6	13.2	8.1	100.0

Source: (13). Data based on only Class I through V commercial farms.

APPENDIX: EXPLANATION OF ASSUMPTIONS FOR THE ESTIMATE OF BEEF PRODUCTION IN 1980

Population: Bureau of the Census Schedule C projections place 1980 population at 232,412,000. The Schedule D projection figure is 227,510,000. A midpoint of 230 million was assumed.

Beef and veal consumption: Culver and Chai estimated 1980 per capita beef and veal consumption at 130 pounds (5). Veal consumption has been declining for many years and was projected at about 1.5 pounds per capita in 1980 by Seaborg in 1970 (11).

Live imports: Cattle weighing 200 to 699 pounds were imported at the listed levels in the following years (7):

Year	Head
1962	1,041,564
1963	688,938
1964	403,375
1965	863,771
1966	828,128
1967	607,842
1968	802,547
1969	792,356
1970	906,992
1971	1/748,873

1/ Preliminary.

This category would encompass most of the feeder cattle imports. Although an increasing demand for beef in the supplying countries of Canada and Mexico could decrease the flow, the increasing U.S. demand for fed beef could provide sufficient price incentive to maintain a flow of feeder cattle into the Nation. A slaughter level of 700,000 head is assumed and may be conservative.

Beef imports: Recent import levels of beef and veal, their percentage of domestic production, and meat subject to quota restrictions were as follows:

Year	Beef and veal imports (carcass weight) (7)	Imports as a percentage of domestic production (7)	Meat subject to quota (product weight) (7)
	Million pounds	Percent	Million pounds
1967	1,328	6.3	895
1968	1,518	7.0	1,001
1969	1,640	7.5	1,084
1970	1,816	8.1	1/1,170
1971	1,755	7.8	1/1,133

1/ Exceeded quota.

Beef and veal imports have been rising steadily since 1956 (except in 1960, 1964, 1965, and 1971). Imports exceeded the quota (established under P.L. 88-482) in both 1970 and 1971. The quota is tied to domestic production; that is, as current domestic production increases, the quota level goes up.

A rising world demand for beef and increasing domestic production may result in stabilizing imports in the future. However, an assumption of 1,500 million pounds (carcass weight) of beef for 1980 would be closer to a minimum than a maximum.

Beef exports: Quantities of beef and veal exports including shipments to territories are listed as follows (7):

Year	Carcass weight equivalent
	Million pounds
1966	87
1967	94
1968	94
1969	87
1970	104
1971	121

Demand for beef is growing in developed economies abroad. The United States leads in production of fed beef. An increasing effort by U.S. producers to develop and supply foreign markets could bring the export level to 150 million pounds in 1980. Though this figure may be too high, the net import figure of 1,350 million pounds for 1980 is not.

Dairy herd: Numbers of milk cows and heifers 2 years old and over have been declining as shown below (8):

Year	1,000 head
1962	18,963
1963	18,379
1964	17,647
1965	16,981
1966	15,987
1967	15,198
1968	14,644
1969	14,152
1970	13,838

The median estimate of the survey for 1980 milk cow numbers is 12,115,000 head. This figure represents a continued decline in the dairy herd; the demand for dairy products has been falling and the productivity of milk cows has been improving.

Beef herd: Results of the survey show an estimated beef herd of 46,276,000 head by 1980. This projection represents continued expansion of the beef industry, although at a slightly smaller rate than has been experienced in the last few years. A continuing high demand for beef is the assumed basis.

Fed carcass: The following procedure was used to determine a carcass weight for fed cattle, using slaughter under Federal inspection in 1969:

Animal	Slaughter (14)		Average dressed weight (8)
	1,000 head	Percent	Pounds
Steers	15,754	66	666
Heifers	8,286	34	562
	24,040	100	

Weighted steer carcasses = 66(666) = 43,956.
Weighted heifer cascasses = 34(562) = 19,108.
Weighted average fed carcass = $\frac{63,064}{100}$ = 630.64 pounds.

When the most recent 5-year averages of dressed weights for steers and heifers were weighted by 1969 slaughter numbers, the weighted average carcass was 632.7 pounds. This figure is 2 pounds heavier than the 1969 weighted

average used in the calculations. Steer and heifer carcasses averaged 18 and 10 pounds heavier, respectively, in 1970 than in 1969. This influence helped pull the 5-year average above the 1969 figures, which appears more representative of current carcass weights.

All calves not counted as vealers, herd replacements, or death losses are assumed to be feeders in 1980.

Cow-Bull-Stag: Carcass weights for cull animals were estimated as follows from weights of slaughter under Federal inspection in 1969:

Animal	Slaughter (14)		Average dressed weight (8)
	1,000 head	Percent	Pounds
Cows	5,998	92	502
Bulls and stags	499	8	706
	6,497	100	

Weighted cow carcasses = 92(502) = 46,184.
Weighted bull and stag carcasses = 8(706) = 5,648
51,832
Weighted average carcass = $\frac{51,832}{100}$ = 518.32 pounds.

Weights of animals from 1969 averages were used in computing the weighted average carcass size for 1980. Although 1970 weights were a few pounds heavier than 1969 weights, weights in previous recent years have averaged a few pounds lighter than those of 1969. Survey data point to heavier cull carcasses in 1980.

Fed cattle death loss: A 1966-67 sample of Colorado feedlots gave a death loss for fed cattle of 0.6 percent. The western Corn Belt had a combined death and marketing loss of 0.7 percent (2). Data from a recent study of Texas and Oklahoma feedlots revealed a death loss of about 1.1 percent (6) A study of Kansas feedlots reported an average death loss of approximately 1 percent in several recent years (10). A 1-percent feedlot death loss is assumed as representative to the nearest whole percent.

Replacement death loss: Statistics show a U.S. death loss of 2 percent for all cattle 1 year old and over (14). A 2-percent death loss is assumed for the beef herd, and 1 percent for the dairy herd. A 1-percent death loss is assumed for herd replacements as they are young, healthy animals.

Beef calf crop: The total calf crop (beef and dairy) was estimated at 90 percent for 1969 and 1970 (8). The percentage has been slowly increasing in recent years and may go up further. This prediction does not consider the possible success and commercialization of multiple-birth techniques for cattle

by 1980. A 91-percent beef calf crop and a 94-percent dairy calf crop approximate the weighted average of 91.6 percent predicted for 1980 by the survey.

Calf death loss: A U.S. calf death loss (including beef and dairy calves) as a percentage of January 1 inventories was computed for the years shown below (8):

Year	Death loss
	Percent
1966	5.6
1967	5.7
1968	5.6
1969	5.8
1970	5.9

Death loss increased slightly in the last 2 years, but 1980 is assumed to have a more favorable level of 5 percent for the beef herd. Improved nutrition and technology are contributing factors. Increased professionalism and competition evidenced by larger herds will also help reduce the death rate.

Beef cow replacement: In the survey, the age of cull beef cows was 7 to 9 years. Assuming 8 years, a cow could have been counted as a member of the herd for only 6 years (definition of herd = cows $\geq$ 2 years old). A "herd-life" of 6 years per cow would require a cull-replacement ratio of about 17 percent (1/6 = 16-2/3 percent) a year to maintain a constant number of brood cows, disregarding death loss.

Beef bull replacement: Assuming one bull per 20 to 30 beef cows and a shorter productive life for a bull than a cow, 1-percent replacement should be close to the necessary amount. As an example, assuming 25 cows per bull, 5-year life of bull, 3-year herd life:

$$\frac{1}{25}\left(\frac{1}{3}\right) = \frac{1}{75} = 1.3 \text{ percent, rounded to 1 percent.}$$

Beef herd expansion: To increase the beef herd from 38,725,000 (7) to 46,276,000 head is an addition of 7,551,000 head. This figure averages over 8 years at 944,000 head per year. The projected expansion during 1980 is $\frac{944}{46,276}$ = 2.04 percent.

Beef herd cull: Replacing 17 percent of the herd with heifers and 1 percent of the herd with bulls would total 18 percent of the herd to cull for slaughter. Statistics show a 2-percent death loss on all cattle 1 year old and over for 1969. Subtracting 2 percent of the herd leaves 16 percent to slaughter as culls.

Dairy calf crop: The dairy calf crop is assumed to be 3 percent higher than the beef herd calf crop because of advances in pregnancy testing and increased culling of nonpregnant cows.

Dairy calf death loss: Dairy calves are a byproduct. Weaned at a few days of age and sold to feeders while quite young, these calves are exposed to handling, transportation, and new environments long before beef calves are. The resulting increased death rate among dairy calves is reflected in an all-calf death loss in the Dairy Belt that is higher than the national average. Although 6 percent is only 1 percent higher than the death loss for beef calves, wider recognition of profits from feeding dairy calves is assumed to stimulate better care of these animals in 1980.

Milk cow replacements: The experts predicted that the average age for cull milk cows in 1980 would be from 5 to 7 years. Assuming an age of 6 years, a 4-year "herd-life" results in a cull-replacement rate of 25 percent for herd maintenance, disregarding death loss. A 5-year cull age could result in a cull-replacement rate of 33.3 percent, which is close to the survey projection. Dairymen who retain a third of their calves for herd replacement, as predicted, may enter only the best three of four animals into the herd. The least desirable would be culled after the final selection is made just prior to breeding time.

Dairy bull replacement: A smaller percentage of replacement bull calves are needed for dairy herds than for beef herds because more widespread use of artificial insemination in dairy herds is projected for 1980.

Vealers: Average dressed weights for calves and vealers slaughtered under Federal inspection since 1963 are shown in the following estimates (8):

Year	Pounds
1963	113.5
1964	114.6
1965	113.3
1966	111.1
1967	106.2
1968	109.0
1969	110.6
1970	112.3

Veal carcass weights from 105 to 115 pounds appear feasible for 1980. The 115-pound assumption removed 3 million head from feedlot eligibility, assuming

that 345 million pounds of veal with be consumed in 1980 (230 x 1.5 pounds per capita).

Dairy herd cull: Twenty-five percent of the dairy herd will be replaced as heifers and 0.5 percent as bulls, totaling 25.5 percent. Because of more intensive management for dairy than beef, a 1-percent smaller death loss is assumed. (25.5 - 1 = 24.5-percent culled for slaughter.)

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